SCIENTIFIC AMERICAN

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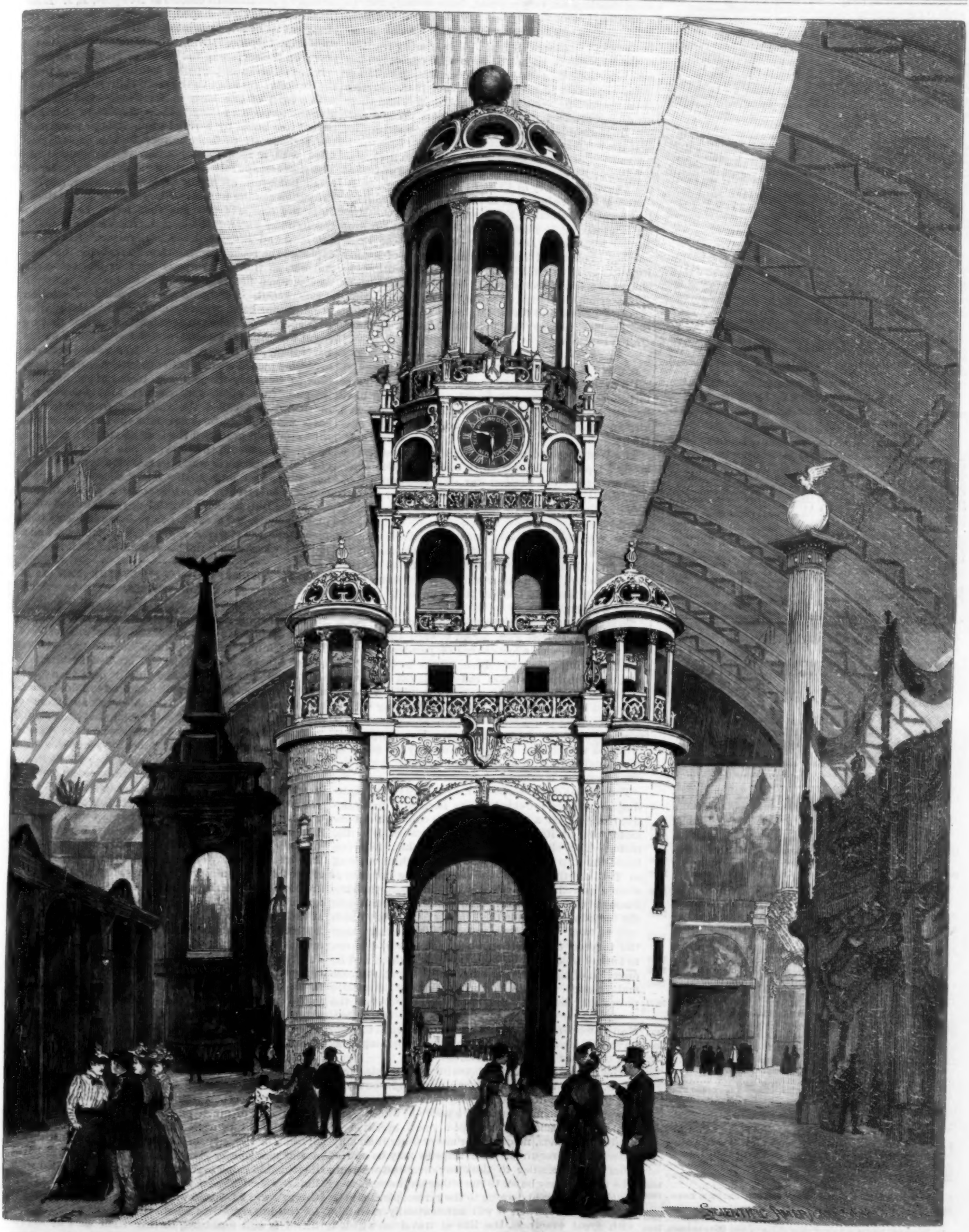

THE WORLD'S COLUMBIAN EXPOSITION.—Fig. 1.—THE GRAND TOWER CLOCK OF THE SELF-WINDING CLOCK COMPANY—PALACE OF THE LIBERAL ARTS.—[See p. 68.]

Scientific American.

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NEW YORK, SATURDAY, JULY 29, 1893.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 917.

For the Week Ending July 29, 1893.

Price 10 cents. For sale by all newsdealers.

THE WORLD'S FAIR INTERNATIONAL ENGINEERING CONGRESS.

The committee in charge of the programme and arrangements for this congress, which opens its sessions on Monday, July 31, has perfected its plans, and there is every promise of the largest gathering of engineers that has ever been held. Headquarters for the engineering fraternity have been established at No. 10 Van Buren Street. These rooms are very commodious and offer every facility for engineers to meet, look after their correspondence, peruse all the leading technical journals of this country and Europe and to enjoy meeting eminent engineers from all parts of the world. In order to facilitate social intercourse, special informal gatherings are held every Monday evening, and these meetings are very popular, from seventy-five to a hundred people usually being in attendance. These headquarters will be kept open for the special entertainment of engineers visiting Chicago during the time of the Exposition. A meeting room for engineers has also been opened in the gallery of the Mining building, in the southwest corner, room number four. In this room the leading scientific papers are on file, and there are almost always a number of engineers present resting from sight-seeing or enjoying the opportunities that the room offers.

The work of this congress comprises seven divisions, as follows: Division A.—Civil Engineering, in charge of the American Society of Civil Engineers. Division B.—Mechanical Engineering, in charge of the American Institute of Mechanical Engineers. Division C.—Mining Engineering, in charge of the American Institute of Mining Engineers. Division D.—Metallurgical Engineering, in charge of the American Institute of Mining Engineers. Division E.—Engineering Education, in charge of a special committee. Division F.—Military Engineering, in charge of Major Clifton Comly. Division G.—Marine and Naval Engineering, in charge of Commodore George W. Melville, Engineer-in-Chief, United States navy.

NAVAL TORPEDOES.

Up to the present time the most practical forms of torpedoes used in connection with vessels of war have been the Whitehead torpedo, worked by compressed air, and the Sims-Edison torpedo, worked by electricity.

The Whitehead torpedo is the one now most extensively adopted, and it was with one of these missiles, delivered from the Chilean war ship Almirante Condell, that the insurgent ironclad war steamer Blanco Encalada was sunk in Caldera Bay on the morning of April 23, 1891.

The Whitehead torpedo, briefly described, consists of a cigar-shaped cylinder of metal carrying in its front end a heavy charge of dynamite, and at the rear two propellers, which are worked by compressed air, with which the main body of the cylinder is charged under a high pressure.

To start the torpedo on its mission of destruction it is placed in a special gun, aimed toward the enemy, and then fired, with a low charge of powder, the propellers having previously been set in motion. The instant the torpedo strikes the water, the revolving propellers take effect and maintain the initial velocity imparted by the gun. The torpedo flies along with a speed reaching thirty miles an hour, and explodes on contact with the intended target. This torpedo is provided with guides or wings and may be made to travel under water, and continues to move until the compressed air is exhausted.

The Sims-Edison torpedo also consists of a cigar-shaped cylinder, provided at its head with an explosive charge, next a reel of small wire cable, an electric motor, and at its rear a propeller is worked by the motor. The electric current is furnished from on board the ship through a wire cable, which reels off as fast as the torpedo advances. The torpedo is steered as well as propelled from on board the ship through the wire cable. The distance of travel of the torpedo is limited to the length of the cable, which may be from one to two miles. Within this range the torpedo may be propelled at the rate of fifteen to twenty miles per hour, may go under water, and its direction of flight can be governed with the utmost ease and accuracy. It has the advantage that its motive power may be indefinitely maintained; whereas the motive power of other torpedoes is soon exhausted. Many successful harbor trials of the electrical torpedo have been made; but we call to mind no example, as yet, of its use in actual warfare.

The Howell torpedo, the invention of Captain Howell, U.S.N., is the simplest device, and might be styled the gyroscopic torpedo. It depends for its motive power upon the momentum of a heavy flywheel. This torpedo is a small cigar-shaped vessel, operated by double propellers, no engine or motor other than a flywheel being required. The torpedo may be started from a gun, similar to the other described weapons. The torpedo may be set to run either on the surface or under the water, and owing to the gyroscopic character of its motive power, it will automatically maintain, with great exactness, the line of travel on which it is set. Prior to discharging the torpedo, its flywheel is set in motion at a high velocity. The flywheel of an 8 foot torpedo is capable of storing up a power of 347,000 foot pounds and driving the torpedo half a mile or more with great speed.

The Cunningham torpedo is a new candidate for warlike honors. It is operated on the same principle as a rocket; its motive power being derived from the burning of pyrotechnic compound, the gases of which issue with force from its rear end, and the reaction drives the torpedo ahead. This device is the invention of Patrick Cunningham, of New Bedford, Mass., who is also the inventor of quite a number of improvements relating to rockets.

The Cunningham torpedo has lately been tried with success by government officers at Newport, R. I. Like the others, it is cigar-shaped, and carries the explosive charge at its head. It is intended to serve either as a submarine torpedo, moving wholly under water, or to travel on the surface of the water, as may be required.

It has no screw or propeller, but has extending from the explosive chamber to the stern eight ribs or spirals, with a twist of one turn in forty-eight feet. These give the torpedo a rotary motion similar to that imparted to a bullet by a rifled gun. All the portion of the torpedo aft of the chamber for the explosive is filled with a rocket composition tightly pressed in. The gases escape forward through a large number of small holes just aft of the explosive chamber, and aft through a smaller number of larger holes in the stern. It is the escape of this gas that forces the torpedo through the water. The torpedo tried was seventeen feet long and fifteen inches in diameter. Electricity exploded the rocket composition. The firing tube was run out, so that the torpedo was four feet below the surface when fired.

The propulsion of boats on the rocket or reaction principle has been several times experimentally tried with success. The last experiment in this line that we recall was that of Buisson and Ciurcu, made on the River Seine, in France, in 1886. In a 25 foot boat the inventors placed a small boiler or receiver, which from time to time they charged with blocks of combustible, the gases from which were conducted into another cylindrical vessel called the reservoir, from which the gases were allowed to escape into the air; the reaction thus produced propelled the boat ahead with great velocity. The office of the reservoir was to hold a reserve of gas under pressure while the main receiver was being newly charged and fired. Many successful experiments were tried, extending over a period of four months. But, finally, one fatal day, from some unexplained cause, too great a gas pressure suddenly took place, and the receiver exploded. Mr. Buisson, and a lad who was steering the boat, both lost their lives.

COLONEL AUCHMUTY, FOUNDER OF THE NEW YORK TRADE SCHOOLS.

Colonel Richard T. Auchmuty died at his summer home in Lenox, Mass., on July 18. He was born in New York in 1831; his great-grandfather was rector of Trinity Church in 1763. Colonel Auchmuty received a college education and afterward studied architecture with Mr. James Renwick and finally became a partner. He served in the civil war, and on his return home devoted himself to charitable work and founded the New York Trade Schools, which he successfully conducted until his death. In 1889, when the schools were incorporated, Colonel Auchmuty and his wife added $160,000 to their previous gifts. J. Pierpont Morgan gave $500,000 at the same time as an endowment fund. At these schools a thorough course of instruction is provided for each of the trades. The branches taught are bricklaying, plastering, plumbing, carpentry, house and sign painting, fresco painting, stone cutting, blacksmith work and tailoring. Low tuition fees are charged and instruction is given either day or evening. The New York Trade Schools are conducted on the principle of teaching thoroughly how work should be done; the scholars actually work at their trades in the school until they become proficient. The system which Colonel Auchmuty inaugurated was a new one and has produced remarkable results. It has attracted much attention both in this country and in Europe, and is regarded by many as the solution of the labor problem. Hundreds of young men trained in these schools have become skilled workmen, and command the highest wages. The trade schools are fully described in our SUPPLEMENT, No. 781.

LIBRARIES IN CHICAGO.

The recent decision of the Supreme Court of the State of Illinois sustaining the will of John Crerar is an incident of much public interest, as it means the establishment of a free public library in the south division of the city of Chicago. Such an institution as this new library gives promise of being will be of inestimable value even to a city as well supplied with libraries as Chicago is, for by the provision of Mr. Crerar's will $2,500,000 was set aside as an endowment for this library. Just where the library will be established is still unsettled, further than that by the re-

quirements of the will it shall be in the south division of the city, or, as it is usually called, the South Side.

This munificent bequest calls attention to the library privileges that Chicago already enjoys, and which are probably not equaled to a corresponding degree by any other city in the country. For years the Chicago Public Library has been noted for the number and quality of its books and for the large number of volumes it circulates among readers. The annual report of this institution recently published shows that it contains 189,350 volumes. It has twenty-nine delivery stations and six branch reading rooms. During the past fiscal year it circulated 2,094,094 volumes and periodicals, and of this immense number 988,601 volumes were for home use. The daily average circulation of books for home use was 3,272. Just at present this library is in cramped quarters in the upper story of the City Hall, but contract has been let and foundation is nearly completed for a new library building, which is to be situated in the heart of the city convenient to the North, South, and the West Sides of the city.

On the North Side of Chicago is a fine library, which, in many of its departments, is without equal in the country. This is the Newberry Library, which, perhaps, by an unfortunate bequest in the will of Mr. Newberry, who founded it, is limited to being a library for reference. The last report of this institution, made six months ago, shows that there are 107,157 volumes and 39,501 pamphlets. This library is especially strong in the departments of music, bibliography, American history, biography, and genealogy, fish, angling, and fish culture. In the department of music it is believed to exceed any other library in the country in the value of its books. This library has an endowment of $3,000,000. A new building has just been erected, and will be occupied in a few months, which is one of the finest specimens of architecture in Chicago. It is an immense building, occupying half a small square, but the other half belongs to the library association, so that at any time when necessary the building can be extended. The books in this library are classified and arranged in departments, and each department will have separate rooms, where the books will be kept and where people wishing to refer to any volume may be by themselves and not in a general reading room. The capacity of this new building is 800,000 volumes.

There is another library in Chicago which is destined to play an important part in the education of the city, and that is the library connected with the Chicago University. This institution is situated at the extreme southern end of the city between Fifty-eighth and Fifty-ninth Streets, and, with its immense resources, both in money and intellect, will undoubtedly soon have one of the finest libraries of any university in the country.

An Ancient Canal in the Crimea.

The Russian engineer Melnikoff writes from Odessa to the Smithsonian Institution, says the Philadelphia *Evening Telegraph*, describing the ruins of an ancient canal discovered in the Crimea, which he regards as one of the wonders of the world.

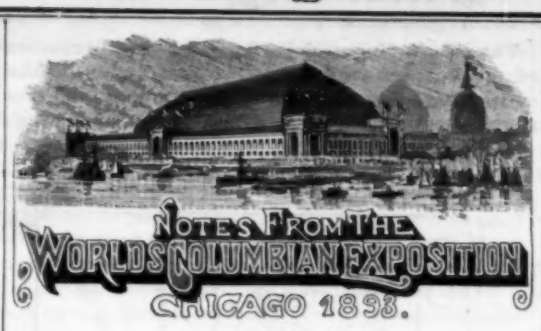
At each end of the western side there was a lofty castle, the ruins of which remain to this day, the cubical contents exceeding 750,000 meters. A part of these stones, as well as those with which the bed of the canal was paved its entire length, were removed some time ago to build a town which adjoins.

During the Crimean war some of the stones remaining were utilized in the construction of hospitals for the wounded soldiers, which structures are still standing. Along the banks of the canal there were at least six towers, but what purpose they served, unless for defense, is uncertain. There was also a high wall, which extended its entire length. At an equal distance from each end there was a gigantic fortress, built in the form of a square and covering a space of 32,400 square meters. The canal is as straight as an arrow its entire length, except at this point, where it forms three sides of a square about the fortress. Here there was a smaller canal on the outer side, which may have provided greater security.

One of the gateways of the fortress is still partially preserved, and through it passes a dilapidated road. The canal was built by Assande I., of Bosporus, in the seventh century B. C., and is nine kilometers long. Mention is made of this in the writings of Pliny and Strabo. It passes by the modern town of Perekop, and is not far from the Greek city of Neapolis. Its width on the bottom was about five meters and its depth ten meters. Whether it served formerly as a great and towering fortification or not, it certainly contained water enough to sail ships of considerable burden.

Artificial Gum Arabic.

According to *Rev. de Chim. Ind.*, a product possessing the properties of gum arabic is obtained by boiling 1 kgm. flaxseed with 8 kgm. sulphuric acid and 10 liters water, filtering after three or four hours, adding four times the volume of alcohol, washing and drying the precipitate. The product is amorphous, colorless, insipid, and dissolves in water like gum arabic.



Compressed air is used more or less throughout the grounds and buildings at the World's Columbian Exposition, and there is a complete system of pipes for its distribution. Four Norwalk compressors are used, also an Ingersoll-Sargent and a Rand compressor. The latter two have a capacity of 200 and 500 horse power respectively. Compressed air operates the elevators in the Transportation building and many freight elevators throughout the grounds. Several locomotives are represented in operation, the energy for this being supplied by compressed air. The air brake exhibit and other exhibits in the Transportation building use compressed air. In the Mining building are several rock drill exhibits, also in the Palace of Mechanic Arts machines are operated by compressed air.

The drainage is divided into three departments. One devoted to the disposal and carrying off of water from the roofs of buildings during storms; another to the surface drainage and disposal of all accumulations of rain water; the third is that of the sewage proper. The rain water from the roofs is emptied direct into the lagoon. The surface drainage from the high grounds flows by gravity into the lake.

The surface drainage from the low parts of the grounds is collected in underground pipes constructed of wood with a bottom of concrete. Three centifugal pumps lift the water, giving it sufficient headway, so that it flows by gravity into the lake. These pumps are operated by electricity. This sewer also carries off the condensing water waste from the Palace of Mechanic Arts.

The remaining general sewerage system of the grounds is operated by compressed air. The main sewer consists of cast iron pipes 30 inches in diameter, and the pressure of air throughout the system varies from 35 to 47 pounds per square inch according to the distance from the sewage pumping plant. Nearly every one of the large buildings on the grounds forms a district in itself. By this division into districts the work of maintaining and operating the system can be more readily carried on and the drainage is more efficient. All sewage is forced through the pipes by the compressed air at a rate of about three feet per second, and is carried immediately to the sewage purifying works, which are at the extreme southeastern corner of the grounds. Here the sewage is made to rise to a tank in the top of the building, where it flows over a sieve and falls into this tank. The sieve separates all the large articles that may be floating in the water, and at frequent intervals they are raked off and taken to the crematory, where they are burned. From this tank the water is distributed by means of pipes into the four precipitating tanks.

Two methods are followed for precipitating the solids in the sewage. In two of the tanks copperas and lime are used and in the other two sulphate of alumina and lime. Large pipes run from the receiving tank direct to each of the four precipitating tanks. The copperas or the sulphate of alumina, whichever is used, is combined with the water as it enters the pipes. As soon as the chemical enters the pipe the water passes through a mixing device, which is simply a sort of paddle wheel, and which thoroughly mixes the chemical with the water. The water then passes on through the pipe, and just before it reaches the tank milk of lime is added. Again the water comes in contact with a device for mixing, so that the chemical shall be thoroughly combined with the sewage. This second mixing device consists simply of a shallow cone. The water pours into this cone, and as it is forced up over the edges, flowing into the precipitating tank, the proper mixing takes place. When the sewage enters the precipitating tank, it does not at once combine with the sewage already in the tank, but passes nearly to the bottom through an inner tank or main designed for this special purpose, then rises to the top outside of this inner tank and passes over an overflow. During the passage of the water down this inner tank and up around the outside of it all solids held in suspension are precipitated, so that the water which flows through the wasteway is nearly clear and is discharged into the lake.

The solid matter, or sludge as it is called, is drawn from the precipitating tanks and passed through a filter press by compressed air at about 104 pounds pressure. The pressed sludge is removed to the garbage crematory, where it is burned. The garbage is collected each night and is carried by the cart load to the crematory, where it is burned. Oil is used for fuel in these furnaces. Refuse is never allowed to accumulate and the garbage is burned every night.

The sanitary arrangements at the Exposition are most excellent, and the system has shown that it is equal to any demands that are liable to be made upon it.

The exhibit made by the Oil Well Supply Company, of Pittsburg, Pa., illustrates in a most perfect manner the skill and science reached in the matter of driving wells for this and other purposes. The exhibit is located in a special building. Working models illustrate the drilling of a well, showing the machinery at work. A second illustrates the manner in which oil is pumped from wells. The structures are inclosed in glass. The Liliputian workmen are armed, as they frequently are in real life, with a bottle of whisky in one pocket and a plug of tobacco in another. The third model is that of a flowing well. All the pipes and tanks for controlling the oil are shown, and the peculiar intermittent flow of the crude petroleum is perfectly reproduced. Derricks used for sinking the wells are also exhibited. There are two large outfits of full size, and such as are built for sinking the deepest wells. The greatest depth yet reached is 4,600 feet. These two large outfits are of different types, one being the most modern, with steel construction and improved power-applying device, while the other is constructed mostly of wood and is of the type that has been so extensively used in the oil regions of Pennsylvania and elsewhere. The company making this exhibit has planned to sink a well 3,000 feet under the steel outfit, and one length of casing, 12 inches in diameter and 30 feet long, has already been driven. Smaller portable outfits are also shown, designed more especially for drilling wells from 800 to 1,000 feet deep. One of these outfits comprises a steam vehicle and adjustable derrick, all in the one machine, which can be hauled by horses or run by its own steam power.

A full line of all the drills, tools for recovering broken drills, torpedoing apparatus, including the go-devil which fires the torpedo, etc., is shown.

The driving of wells in this country is done on what is called the cable system; that is, steam or other power is used for operating the drill, which is suspended on a cable. But in order to add completeness to the exhibit and to compare latest improved methods as utilized in this country with cruder methods as used in other countries, there is shown a complete pole outfit, which consists of splices of poles which are fitted together.

The rest of the exhibit in this building consists of a full line of engines from 12 to 60 horse power, valves and fittings of all kinds, some of the valves being as large as 30 inches in diameter; pipe-threading machines, and a fine line of photographs illustrating the oil well business in all its phases, from the preliminary work of preparing the well to complete buildings, flowing wells, tanks and wells on fire, etc. A large framed picture shows the first oil well that was drilled by Colonel Drake, near Titusville, Pa., in 1859.

In the Horticultural building the wine exhibit is very extensive. The most noticeable pavilion in this department is the one erected by the four California wine producers, C. Carpy & Co., Arpad Haraszthy & Co., Napa Valley Wine Company, and J. Gundlach. This pavilion is constructed of the bark of a giant redwood tree, from Mendocino County. The tree from which this bark was taken was 30 feet in diameter at the base and 290 feet high. The section which this pavilion represents is 47 feet high, and 9,765 pounds of bark was brought from California to use in this structure. Two passageways afford entrance into the lower part of the pavilion, and a narrow winding stairway leads up through it, giving egress to the gallery floor. Over the entranceway, at the right, is a statue of a Franciscan father, representing him in the act of tilling the soil. These representatives of the church first established grape culture in California in the old mission days. Over the left entranceway is a figure of an Indian woman, such as were connected with the mission stations in the early days. Between these two statues is a third one, representing one of the figures by Schmidts, typical of California. Growing up from the base of the tree are grapevines, with an abundance of ripe fruit hanging from the vines. The interior of the tree affords a spacious room, in which there is considerable display of the products of the vineyards.

Adjoining this pavilion is the pavilion and exhibit of Leland Stanford's Vina vineyard.

Two rooms, each of much length, are utilized for the fruit exhibits, those of oranges and lemons being very attractive. The largest exhibit of these fruits comes from the counties of San Bernardino and Los Angeles, California. At one end is a large pyramid of lemons and oranges; at the center is a model of the Liberty bell, entirely covered with oranges, except for the black zigzag space left to represent the crack in the bell. Tropical plants, glasses of preserved fruits, photographs, and other things add to the attractiveness of this exhibit. Smaller exhibits of oranges and lemons and grape fruit are made from other counties in California, as well as from other parts of the world, the exhibit from the most distant points being made by New

(*Continued on page 70.*)

THE GREAT EXHIBIT OF THE SELF-WINDING CLOCK COMPANY AT THE WORLD'S COLUMBIAN EXPOSITION.

Clocks are among the few inventions of mediæval origin which have withstood the test of ages. Since the production of the first time-keeping machine by an inventor unknown to us, it has been improved, made in complex forms, simplified, cheapened, and to-day clocks are to be found in every city and hamlet, and in almost every dwelling on the globe. In its present form it is as nearly perfect as human ingenuity can make it; but, notwithstanding the great perfection of the clock as a machine, there are certain inherent defects which prevent it from being absolutely perfect as a timepiece. Variations of temperature and of atmospheric conditions have their effect, and in spring clocks (which have almost superseded weight clocks for general use) variations in the time of winding are unfavorable to accurate running. Taking these causes of variation in addition to occasional running down and the lack of close regulation, it matters little how perfect the mechanism may be, the common clock is pretty certain to gain or lose a small amount each day, so that in a short time, possibly before it is noticed, it is out perhaps from one to ten minutes—an amount quite inadmissible in these times.

All these difficulties are remedied by the ingenious electro-mechanical devices applied by the Self-Winding Clock Company, of New York, to their clocks. Our attention has been directed to this subject by the remarkable exhibit of this company at the Columbian World's Fair at Chicago. The exhibit includes a pavilion containing samples of the manufactures of the company; a magnificent clock tower 150 feet high, having four 7-foot dials, 70 feet from the ground, 200 self-winding clocks placed in different localities on the ground, all controlled by the master clock at the pavilion. There is also exhibited in the clock tower a complete chime of nine bells, very beautiful in tone, and weighing over 14,000 pounds. These bells are the manufacture of the Clinton H. Meneely Bell Company, of Troy, N. Y., and constitute a joint exhibit by them and the Self-Winding Clock Company. In addition to these, there are two three-dial clocks in the towers in the railway terminal building, and twenty-four clocks showing the time of day in the principal cities of the world, in the waiting room of the station. The pavilion is very artistic in design and decoration, being the work of a Paris architect. Its roof is supported by massive columns, and at each corner, near the cornice, is placed a clock.

The self-winding clock in its simplest form consists of an ordinary train from the center arbor to the escapement—the other arbors and wheels and the mainspring being omitted—a fine spring 6 feet long, $\frac{1}{17}$ of an inch wide and 0·006 of an inch thick, attached at its inner end to the arbor, and at its outer end to the spring barrel, and an electric motor arranged to wind the spring once every hour. By a simple attachment the electric current is made to pass into the motor, which quickly and silently carries the spring barrel around once, thus storing sufficient energy in the spring to run the clock for one hour. The motor is supplied with a current by a small battery concealed in the clock case. In winding the spring, its outer end is carried in the direction the inner end moves in unwinding. In consequence of this arrangement, the auxiliary maintaining power usually found in good common clocks is dispensed with. As a result of the frequent winding and reduction of friction, the power required to run a clock according to this system is only $\frac{1}{40}$ part of that used in ordinary clocks. The motor will run for a year without attention, and at an expense of less than twenty-five cents.

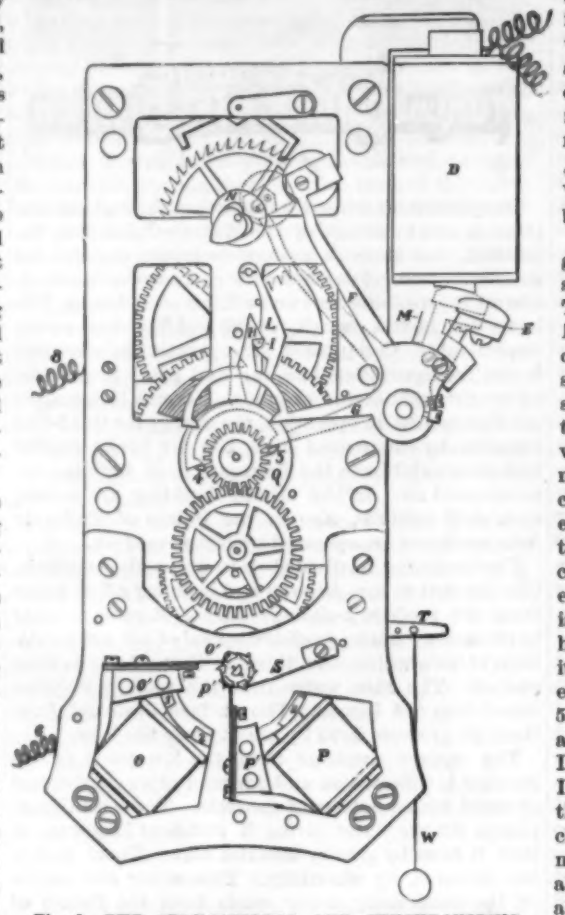


Fig. 3.—THE SELF-WINDING AND SYNCHRONIZING MECHANISM.

The master clock at the pavilion is provided with a gravity escapement invented by Mr. James H. Gerry, superintendent of the Self-Winding Clock Company. This clock synchronizes all the clocks throughout the Exposition grounds and buildings by an hourly electrical impulse which instantly corrects every clock to the second. The mechanism by means of which this result is secured is shown in Fig. 3. All clocks intended to be used in the synchronizing circuit are provided with the synchronizing magnet, D, and with mechanism associated with its armature lever and the clock movement. On the minute hand arbor is mounted a disk, Q, provided with two projections, 4, 5, and the second hand arbor is provided with a heart shaped cam. The armature, E, is rigidly attached to the levers, F, G, so that they move whenever the magnet, D, is energized. The lever, F, is adapted to engage the heart-shaped cam on the second hand arbor and bring it to XII, and the lever, G, is furnished with a curved end having fingers for engaging the projections, 4, 5, on the minute disk, thus turning the minute hand arbor, bringing the minute hand to XII. A latch, L, pivoted to the clock frame is provided with a pin, I, arranged to drop under the hook, H, carried by the lever, G, so as to prevent any action of the synchronizing levers except at the hour. A pin in a disk mounted on the cannon socket unlocks the latch, L, about fifty seconds before the hour, and closes it again about fifty seconds after the signal. This arrangement prevents any accidental cross on the synchronizing line from disturbing the hands during the hour. This diagram, besides showing the synchronizing arrangement, gives a good idea of the great simplicity of the self-winding clock.

The system which is thus illustrated in this exhibit of the Self-Winding Clock Company is an accurate

Fig. 2.—THE PAVILION OF THE SELF-WINDING CLOCK COMPANY PALACE OF LIBERAL ARTS CHICAGO.

representation of the system developed by them in connection with the Western Union Telegraph Company, for a uniform time service, and which, in extent, embraces the whole of the United States. They now have over fifteen thousand of their clocks in circuit, which are synchronized daily by the telegraphic time signals from the time service of the United States Naval Observatory at Washington. These clocks are either sold or rented. It will thus be seen that time is bought and sold, and is in fact made an object of merchandise, though not at the exorbitant rate proposed by the sovereign who offered millions of money for an inch of it. The government furnishes correct time free to its citizens, but they must get it at the Naval Observatory at Washington. As it is impracticable, if not impossible, for them to do it individually, the Western Union Telegraph Company daily forwards it to every part of the country. Three minutes before noon, all general business is stopped, and direct communication made with the capital. Precisely at twelve o'clock a single electric impulse announces the time all the way to the Pacific Coast. The cost of this service is one dollar per month, or twelve dollars per year for each clock. This places standard time within the reach of everybody.

There are standards of weights and measures, of distance, and we are pleased to note that now there is a standard of time available for every one at a nominal cost, whereas formerly the cost was such as to permit only of the most prosperous jewelers obtaining time signals; the service was very incomplete and very expensive. Now, not only jewelers are served, but the general public, including trust companies, banks, commercial houses of every description, factories, schools, and private houses, and the service has proved most accurate and reliable.

While the time service is the main business of the company, it has also a large business in selling clocks. All clocks made by them are of high grade, and, in addition to their ordinary styles of self-winding clocks, such as are used in dwellings and places of business, they also make a feature of specialties, which are unique and interesting. For instance, the company manufactures a programme clock which makes a signal contact at the beginning of each minute and is connected to a commutable signal instrument so arranged as to close electrically a circuit any minute or any number of minutes in the twenty-four hours. This invention is not only very useful for train dispatchers on railroads, but also for schools, for indicating the hours for commencing and ending recitations, etc., by ringing bells or giving other signals.

The chiming clock is also an interesting feature. This is a clock in which the tubular chimes are operated electrically and in which any tune within the compass of nine bells can be played. The most unique feature in this direction is the large chimes in the tower already mentioned. These chimes are fitted with special hammers and magnets, by means of which the large bells may be struck electrically. This electrical mechanism is so arranged that it can be played automatically at predetermined times by means of clock mechanism, or an operator can sit at a keyboard, which ordinarily would be placed in an organ loft or any convenient place at a distance from the tower, and any one at all familiar with music can play on the immense bells, which by the old method would require all the strength of a man to operate. At the Fair a lady plays these chimes twice a day seated at a small case placed in the booth. This method is likely to revolutionize the present method of ringing chimes.

In Fig. 4 is shown a motor for driving the hands of the tower clock. This consists of a small Edison electric motor geared to the arbor which revolves the hands. The motor is connected with a storage battery or with the street current through a relay, and the relay is operated by a current controlled by the master clock. When the circuit of the relay is closed the current is made to pass through the motor, thus turning the minute hand through one minute space. By an ingenious automatic arrangement the motor is stopped when the limit of the movement is reached. Thus every minute an impulse is sent to the motor in the clock tower, causing the hands to move forward by a step-by-step motion, each movement representing one minute. The striking of the hour and quarters is effected by an electro-mechanical arrangement controlled by a striking movement in the pavilion. The machine used for tower purposes is light and simple, and may be placed upon any floor, while the controlling clock may be placed in any position in the building, or even at a distant point.

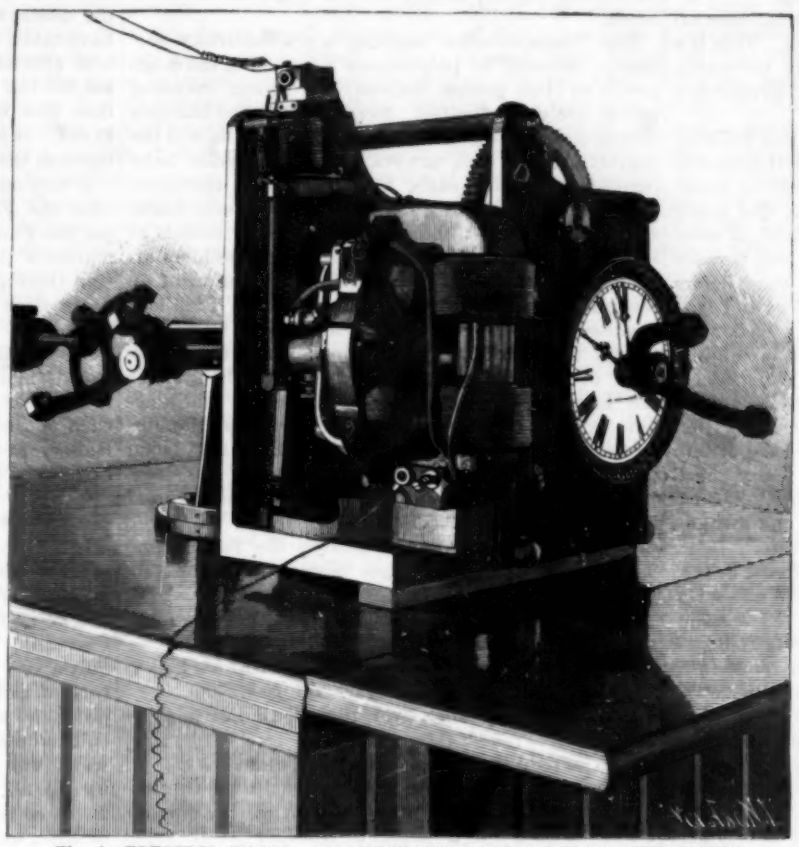


Fig. 4.—ELECTRIC MOTOR AND MECHANISM FOR DRIVING THE HANDS OF THE TOWER CLOCK.

Though the Self-Winding Clock Company has but just entered the field for supplying tower clocks, it is rapidly introducing those of their make in the different towns and cities. The fact of being able to produce an accurate tower clock which will operate perfectly without reference to the steadiness of the tower or the location of the controlling clock, is leading to the introduction of the electric tower clock in places where the ordinary weight and pendulum clock would be impracticable. The New York offices of the Self-Winding Clock Company are located at 26 Broadway.

THE most noted lighthouse in the United States is at Minot's Ledge, in Massachusetts Bay.

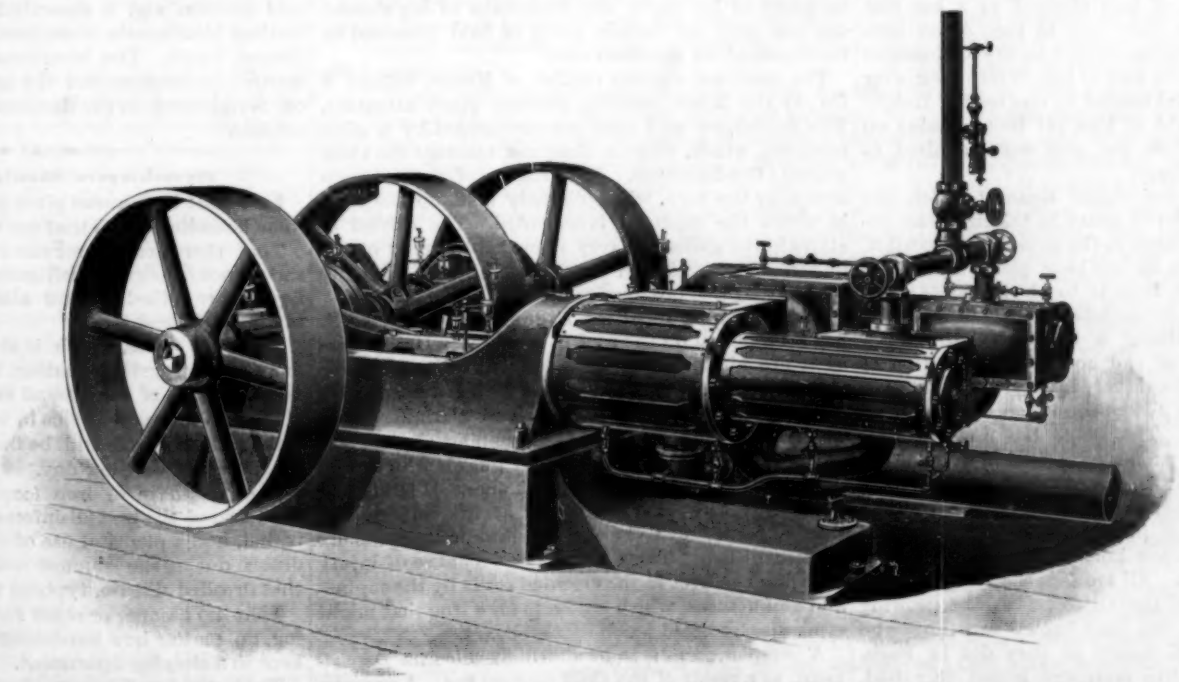
The Effect of Sunlight on Bacteria.

The second report to the Water Research Committee of the Royal Society has been drawn up by Professors Percy F. Frankland and H. Marshall Ward. It deals chiefly with the manner in which the vitality of pathogenic bacteria is affected by the presence of nonpathogenic or saprophytic forms. *Bacillus anthracis*, being one of the hardiest forms of pathogenic organisms when in the spore condition, was taken as a type. *The British Medical Journal* says: "One of the most interesting results elicited is the effect of sunshine in destroying spores. In the dark, and at moderate temperatures, the spores of anthrax retain their powers of infection for many months in any of the waters experimented with, fresh or sterilized. But in direct sunlight the spores undergo rapid destruction; and it has been definitely proved that this destruction is directly due to the light rays, especially at the blue end of the spectrum, and not either to a rise of temperature or to any action of the solar rays on the medium. Moreover, the experiments prove that the bacteria spores are really killed, and not merely retarded in development.

"A great difference, however, was observed in the behavior of spores according as they were introduced into sterilized or into unsterilized water. Infected sterilized waters, after standing for upward of seven months, were invariably fatal to the animals into which they were inoculated, whether they were preserved in absolute darkness or in diffused daylight. Direct sunshine was, however, rapidly fatal to anthrax spores in these waters within 84 hours. In unsterilized waters, the results were different. The spores degenerated; and, although by special methods they could be revived, they were no longer recognizable by ordinary cultivation methods after the lapse of a few days. To summarize the results, the authors state generally that there is one natural agency at least which destroys anthrax spores in surface water, viz., the action of direct sunshine. Whether or not the activity of water bacteria may be added as a second bactericidal agent, is not definitely determined; but, of the two, sunshine is by far the more rapid and potent. In no case does the evidence support the view that the *bacillus anthracis* can live and multiply like a water bacterium in ordinary waters."

DUPLEX TANDEM COMPOUND ENGINES.

These engines, as shown in the exhibit of the Watertown Steam Engine Co. at the Chicago Exposition, present many advantages, in addition to the pleasure they always afford an engineer from the superior workmanship evident in their construction. From the close connection between the two cylinders on each side it is evident there can be but little loss from condensation, while the use of a four-ported valve permits very rapid entrance and exit of steam. A cut-off valve is applied to both the high and low pressure cylinders, the tandem arrangement of which allows of cushioning at the end of the stroke, enabling the engine to attain a high speed under a heavy load without pounding. All the engines made by this company are subjected to a rigid inspection when completed, being placed on a foundation and tested under all the conditions that will be required of them, from the lightest load to the heaviest, including careful indicator and speed tests. They are especially designed to run at a very high speed, permitting direct connection to rapid motion machinery without the intervention of gearing or countershafts.



WORLD'S COLUMBIAN EXPOSITION—DUPLEX TANDEM COMPOUND ENGINES OF THE WATERTOWN STEAM ENGINE CO.

THE organist at a Cardiff church found several of the keys soundless, and upon examination saw that six birds had built their nests in the pipes.

WORLD'S FAIR NOTES.

(*Continued from page 67.*)

South Wales, Australia. The most conspicuous exhibit is a tower of oranges reaching to the ceiling of the room. A placard says that this tower contains 13,873 oranges. Florida's leading exhibit consists of an arch of Florida golden russets, "the most delicious oranges on earth," according to a placard. Florida makes several other exhibits of oranges and lemons and grape fruit, and also jars of sliced and preserved fruit. The inner court, near the north end of the building, is an open space of considerable area, and here California makes an exhibit of a grove of many trees of oranges and lemons with the fruit on the trees.

Probably the largest piece of rolled metal ever exhibited is shown in the Mining building. This is a steel plate seven-sixteenths of an inch in thickness, twenty inches wide, and one hundred and twenty feet long.

The exhibit made by Pennsylvania in this building gives a very instructive idea of the mineral resources of this State. Petroleum, fire clay, building stone, terra cotta, glass-making materials, slate, and many other minerals are also shown. The exhibit of most historical importance is a model of an iron furnace such as was used about four hundred years before Christ. The Philadelphia and Reading Coal and Iron Company's exhibit consists of a model of a coal mine and a coal breaker, showing the method of mining, breaking, and shipping anthracite coal. The model is complete in every respect, with seams of coal, engines, pumps, breakers, etc., showing the entire operation from cutting the coal from the seam to loading it into the cars. This company also exhibits many specimens of coal representing seams in section. The exhibit of iron ores is also very satisfactory, and includes nearly every kind of iron mined in the State.

The Viking ship, which was illustrated in the SCIENTIFIC AMERICAN of May 20, reached the World's Columbian Exposition on Wednesday, July 12. A splendid reception was given to this famous craft and crew by a large number of officials and foreign representatives, including nearly a score of Norwegian societies. Several large excursion steamers and the two government vessels met the ship off Evanston and escorted it to the Exposition grounds. As the ship approached its anchorage adjoining the wharf and just astern of the model war vessel, it furled its sail, and the members of the crew took to their oars and rowed into port in true Viking style. It was a memorable coincidence that these men who came from Norway to Chicago in this vessel modeled after a type of craft used one thousand years ago should be met at the Exposition grounds and transferred by the type of vessel of the future—one in which the motive force was electricity. An address was delivered by President Palmer, of the National Commission, and Captain Andersen, master of the Viking ship, responded. At the close of his address he signaled to the men of his crew, who mounted the platform and gave the Viking cheer.

In the Agricultural building the most instructive brewing exhibit is that of the Bartholomay Brewing Company, which consists of a miniature brewery in operation. It contains all the necessary machinery of a complete brewery.

The dairy exhibit is very fine. Here are exhibited in much variety every conceivable device used in a dairy for cooling and caring for the milk, churning and working the butter, etc. The east gallery only lacks a few swarms of bees to make it a complete apiary. The exhibit of hives and honey is very large and is made by many States.

Among the features of the Michigan Logging Camp is an enormous load of logs chained to a log sled labeled "The World's Fair load of logs, 36,055 feet. Hauled by estate of Thomas Nester to the Ontonagon River, 1893. The largest load of logs 18 feet long ever hauled in the world and hauled by one team. Height 33 feet 3 inches, weight of logs 144 tons; hauled on bunks 16 feet long. Nine flat cars were required to convey the logs to Chicago."

The Blake, a schooner-rigged steamer which has been used for a number of years in taking ocean observations, has been added to the government exhibit. The Blake is tied up to the long pier. The object of bringing this vessel here is to show people interested in marine and commercial matters the system now in use for obtaining a knowledge of the sea coast, the character of the bottom, the location of reefs, etc. The apparatus is very interesting. The deep sea sounding machine allows soundings of a depth of 27,000 feet to be made. The Blake has a peculiar arrangement which allows her to anchor in water 12,000 feet deep. The exhibit is one of the most interesting which the federal government has provided.

The Javanese village in the Plaisance is composed of curious little bamboo houses covered with matting and straw thatch. All around the village, which looks like a dream of the Orient, with the growing palms, may be seen the tiny brown creatures who have already won all hearts as they did in Paris. The music of the native orchestra is not very bad, and the dancing is excellent. The little people have a very curious mode of greeting. They place their hand in yours, and then turn their fingers back until they almost touch the back of the hand.

The exhibit of the terra-cotta reproductions of the Tanagra figures is very fine. Two houses exhibit, one in the Austrian section and one in the English section, though the goods are made in Denmark. The figures, which average only eight or ten inches high, are modeled in the purest classic forms, and are colored in light tints, the color being fired in. The originals are very expensive, costing from five hundred to one thousand dollars. The little figures are very beautiful, and the reproductions may be purchased for as many dollars as the originals cost hundreds.

The Transportation building is a wonderfully successful example of polychrome decoration, the huge arches of the golden doorway in broad, receding planes are very effective. Everything in the building relates directly or indirectly to transportation, and the exhibit includes cash carriers, bicycles, tricycles, baby carriages, wagons, carts, trucks, hearses, elevators, street cars, everything relating to railroads, boats, steamboats, tourist companies, etc. The models of steamships exhibited by their owners or builders attract great attention, while the large section of an ocean steamer exhibited by the American Line is a never-ending source of wonder to visitors. The two special transportation buildings devoted to the exhibit of the Pennsylvania and Vanderbilt systems are interesting, some of the old tickets and time-bills being very curious, a poster issued by the Jefferson, Madison and Indianapolis Railroad being peculiarly so. It seems that the railroad was troubled by frequent requests for passes, so they printed the following poster. The heading reads: "In those days there were no passes. Search the Scriptures." Then follow several passages bearing upon the subject:

"Thou shalt not pass."—Numbers xx. 18 v.

"Suffer not a man to pass."—Judah.

"The wicked shall no more pass."—Nahum i. 15 v.

"None shall ever pass."—Mark xiii. 30 v.

"Though they roar, yet they shall not pass."—Jeremiah.

"So he paid the fare and went."—Jonah i. 3 v.

The exhibit of the dead letter office in the Government building contains many curiosities, including a letter written on a shingle. Another letter says: "If not delivered in thirty years return to—" Wedding cake, candy, fruit, snakes, tarantulas, and nearly every conceivable thing finds its way into Uncle Sam's mail bag. A curious article in the collection is a neatly bound book, labeled "Ireland's True Spirit in Spiritual Sermons," while out from the nicely marbled edge protrudes the neck of a bottle, which formerly contained a sample of Ireland's spirit.

The detective service is excellent, and the staff includes detectives from the principal countries of Europe. If a robbery occurs, the description of the man is telephoned to every exit, and there is little chance of escape. Indeed, the service is so good that professional criminals are leaving Jackson Park severely alone.

The ambulance service is in fine running order, and may be summoned by the guards from any of the numerous police boxes. Over 5,000 workmen were injured during the period of construction of the Fair. The hospital is thoroughly well equipped, and competent physicians and nurses are in attendance.

The East Indian prince, the Nawab of Rampur, is at the Lexington Hotel, and is busily engaged in studying the Fair. He has his own cook, as some of the members of his party are Brahmans of high caste, and can only eat certain kinds of food prepared by the hands of an anointed cook.

The diamond cutting exhibit of Messrs. Tiffany & Co., in the Mines building, attracts much attention. The machinery and men are surrounded by a glass partition, which, while it does not obstruct the view, protects the diamonds. The progress of the cutting is shown by the men, who obligingly hold up the stick in which the diamond is cemented. The exhibit of alloys in the gallery is very remarkable, many of the imitations of gold and silver having been made up specially by this progressive firm.

The "Mocking Bird" is a large steam whistle, which has been placed on the roof of Machinery Hall for use as a fire alarm. The note of the whistle can be altered by insensible degrees over two octaves, so as to give out a sound that is weird and alarming. The whistle will be blown from the pumping station, and at the first blast all firemen and guards who are off duty will proceed to the fire at once. It is also intended to notify guards on duty at the buildings to shut all doors and to keep the visitors in until the fire is extinguished. There is always a chance of injury by being run over in the crowded roads by the engines and ambulances, which accounts for a rule that might otherwise be called harsh and arbitrary.

A pompier corps is to be added to the Fire Department, as a result of the Cold Storage fire. A pompier corps is a band of firemen skilled in scaling buildings by short ladders, which they pull up after them. The equipment includes ladders, netting, ropes, and other appliances. It is said that many of the men could have been saved at the Cold Storage fire if such a corps had existed.

The auditor of the World's Fair has presented a very interesting statement of the financial condition of the Exposition. The cost, up to June 30, $20,620,160. The balance in favor of the Fair, for the months of May and June, is $1,127,417. Important reductions in expenses have been and will be made. The railway tracks in and about the grounds cost $402,237; the symphony orchestra has cost $55,820 so far; the Columbian Guards have entailed an expense of $555,233; the postage bill amounts to $59,696; the architects have taken $169,558; the statues on the grounds have cost $198,830; the photographic concession has cost $45,140, the receipts for the same have been $46,535, so that this important concession has paid a profit of $1,395. It is interesting to note that the total receipts through the concessionaires have been $580,006.

A very natural question for any one who is about to visit the Fair is, "How long a time will I require to see the Fair properly?" This is, of course, largely a matter of personal opinion, but it can be safely said that the Fair can be seen in a satisfactory manner in seven days and two evenings, if the grounds are reached at nine o'clock in the morning and left at six o'clock in the evening, except the two nights, when a stop is made for the illumination. To see the Fair more leisurely ten to twelve days will be required. If each of the eight thousand works of art in the Art Gallery are examined individually, the time would have to be increased.

Potash, Soda and Magnesia from Kainit.

In *Le Genie Civil*, M. D. Lidersky describes the new process adopted by the Buckau Chemical Company, of Magdeburg, for producing pure potash, soda and magnesia from the kainit deposits of Stassfurth, Germany. Most of this kainit is sold as manure, and only a very little has been employed in the manufacture of potash, partly because so many useless by-products were found, and partly because it was difficult to obtain a pure potash with the Leblanc process, which was the only one employed. The new process uses up all the by-products, and besides potash it produces soda, calcined magnesia, crystallized sulphate of lime, hydrochloric acid and sulphuric acid. The average composition of the kainit used is $MgSO_4$ 16–18 per cent; K_2SO_4 22–24 per cent; NaCl 30–34 per cent. These salts are first converted uniformly into sulphate, by treatment with sulphuric acid. The hydrochloric acid produced is condensed. Concentrated milk of lime is then added to the boiling solution of sulphates to decompose the magnesium sulphate. The lime dissolves, but when left at rest for some days after slow cooling, the sulphate of lime separates out as a heavy crystalline powder covered with a lighter deposit of magnesia. The solution is then removed and the magnesia and sulphate of lime washed, separated, and collected in a filter press. The solution is then treated for the separation of the potassium and sodium salts. Barium sulphide is added with the resulting production of insoluble barium sulphate and solutions of the alkaline sulphides. The solution is boiled down to a strength of 20° B. and subjected to the action of pure carbonic acid gas obtained from the decomposition of alkaline bicarbonates. The sulphides are decomposed; sulphureted hydrogen is evolved, and bicarbonate of soda and potash formed. The sulphureted hydrogen is burned and converted into sulphuric acid. The bicarbonate of soda is almost insoluble in the cold solution, and is separated by filtration. The potassium bicarbonate is obtained by boiling down the filtered liquid. The bicarbonates are calcined into neutral carbonates, and the carbonic acid gas driven off is employed in the decomposition of the alkaline sulphides.

Housekeepers Should Remember.

Katherine B. Johnson gives in the *Albany Cultivator* some household hints that are very seasonable.

That there are few servants so thorough that they should not inspect the refrigerator daily to see that no liquids are spilled or food allowed to spoil and contaminate the rest.

That dish water, which is always impregnated with more or less vegetable matter, should never be thrown on the surface of the ground at the back door.

That all tubs and basins in bath rooms and kitchen sinks and drains should be flushed with hot water on every weekly washing day.

That sulphate of iron (copperas) and chloride of lime, two of the best disinfectants, are but ten cents a pound, and a plentiful use of either in sinks and open drains during the summer and autumn may prevent that dreaded disease, typhoid fever.

That no hamper or other receptacle of soiled clothing, no matter how handsomely decorated, should be kept in a sleeping apartment.

That powdered borax, plentifully used, will exterminate cockroaches and water bugs.

Natural History Notes.

The Production of Sound in Ants.—If we consider that ants have the faculty of producing a sound perceptible to our ear by rubbing a part of the body, the hypothesis that these insects possess also the faculty of hearing acquires a certain likelihood. Landois and Lubbock mention as probable that the organ that produces this sound is in the posterior part of the insect's body. Yet they furnish no proof of it. It, therefore, appears to us of interest to quote the following short passage from a work by Robert Wroughton upon the noise produced by ants in the Indies:

"I am almost certain of having heard these sounds. When one of the gray paper nests of *Cremastogaster regenhoferi* is suddenly and violently shaken, the ants escape by thousands, moving their abdomen in the manner so characteristic of the species of the genus when they are excited. From time to time there is distinctly heard a slight hissing, as if a red hot coal were being plunged in water. I had always supposed that this noise was caused by the friction of the legs of the ants against the sides of their nest. An analogous, though febler, sound may be perceived when a large nest of *Camponotus* or *Polyrhachis spinigera* is disturbed. It is produced then by the friction of the bodies of the ants, which suddenly enter into active motion. However, the passage from Lubbock that I have just cited leads me to think that there is nothing in this but that the noise heard is produced by the mass of innumerable ants. The motion of the tail of the *Cremogaster* would explain why the noise that they make is louder, although they are much smaller than the *Componoti* or the *Polyrhachides*. I asked Mr. Aitken to make some experiments in order to confirm the results that I thought I had obtained. He will, doubtless, be recognized in the following note, confirming my assertions:

"I have no need of making an experiment. The noise produced by a host of *Lopobiltæ*, when they are stirred up with a straw, is heard without the necessity of placing the ear close by. I should like, however, to know something as to the nature of those organs. What is their role? Are they military drums?"

Twenty years ago, Mr. Auguste Forel described in our European *Camponoti* a signal of alarm, consisting of a peculiar noise: "Not only do the *Camponoti* strike themselves forcibly, and with repeated blows against each other, but, at the same time, strike the ground two or three times with their abdomen, and repeat this act at short intervals, thus producing a very marked noise that is heard especially well when the nest is in the trunk of a tree."

Forel's theory is confirmed by several of my observations upon the *Camponotus ligniperdus*, and I have nothing to add thereto. There is no doubt that this signal of alarm is understood by the ants. Without that it would not be an alarm signal. But the question is to know whether the noise perceived by the ants is perceived as a sound through a sort of hearing, or as a simple shock by the touch by means of a slight friction of the lower limbs upon the bottom of the nest. Ants, in fact, are provided with hairs under the legs for the purpose of feeling. In order to elucidate the question, the examination would be more favorable if it extended to different species of our myrmides, which show their anger by a violent motion of their posterior legs. They seem to make use of their first sting for rubbing their *metanotum*.

Unfortunately, the species of which we have just spoken are almost too small, except the *Myrmica rubida*, which is too quiet to permit of proving distinctly the production of sound in these animals. Two years ago I published a work upon the touch of insects. This observation is, perhaps, still unknown to specialists, and it is for that reason that I communicate it here once again.

One very hot day I had put a portion of a large colony of *Myrmica ruginodis* into an empty glass globe. The ants were much agitated and rubbed their posterior legs violently. On seeing this motion executed by a large number of individuals at the same time, I heard a slight droning that recalled to me the sounds made by a coleopter, the *Mononychus pseudacori*, which lives in the fruit of gladioli. Unfortunately, I did not succeed in renewing this observation in the experiments that I made later on.

We find in a monthly entomological review a note by A. H. Swinton on the sound of the *Myrmica rugidinodis* and other Hymenoptera. He observed a small female worker (not a male, as he thought) that was violently agitating its posterior l gs. He made an examination and afterward found organs that probably produced a sound at the base of the posterior legs and of the second sting.—*E. Wessmann, in Biol gische Centralblatt.*

Localization of the Senses of Sea Anemones.—Herr Nagel has recently been conducting some experiments at Naples, having for their object the localization of the various senses of sea anemones. The results of his researches have shown that the sense of taste resides in the tentacles; and that though the tentacles were apparently unsusceptible to pain when cut, yet when touched, or when heated substances were placed near them, they gave evidences of being most sensitive. They are, therefore, the seat of three senses, viz., of touch, taste, and smell.

Habits of Brazilian Roaches.—Cockroaches are so common in Brazilian country houses, says Mr. Herbert Smith, in *Insect Life*, that nobody pays much attention to them. They have an unpleasant way of getting into provision boxes, and they deface books, shoes, and sometimes clothing. Where wall paper is used they soon eat it off in unsightly patches, no doubt seeking the paste beneath. But at Corumba, on the upper Paraguay, I came across the cockroach in a new role. In the house where we were staying, there were nearly a dozen children, and every one of them had their eyelashes more or less eaten off by cockroaches—a large brown species, one of the commonest kind throughout Brazil. The eyelashes were bitten off irregularly, in some places quite close to the lid. Like most Brazilians, these children had very long, black eyelashes, and their appearance thus defaced was odd enough. The trouble was confined to children, I suppose, because they are heavy sleepers and do not disturb the insects at work. My wife and I sometimes brushed cockroaches from our faces at night, but thought nothing more of the matter. The roaches also bite off bits of the toe-nails. Brazilians very properly encourage the large house spiders because they tend to rid the house of other insect pests.

Tannin Receptacles of the Leguminosæ.—Dr. P. Baccarini has made an exhaustive examination of the structure and distribution of the tannin receptacles in a large number of *Leguminosæ*, belonging to all the three tribes, *Papilionaceæ*, *Cæsalpinieæ*, and *Mimoseæ*. These special receptacles are especially well developed in the *Loteæ*, *Galegeæ*, *Phaseoleæ*, and in some *Hedysareæ;* though the tannin is by no means confined to these receptacles, but may be distributed in other portions of the tissue. In the *Podalirieæ*, *Genisteæ*, *Trifolieæ*, and in some *Galegeæ* they are altogether wanting. When present, they may be either associated with the vascular bundles (para-fascicular) or independent of them (extra-fascicular), and one only or both of the systems may occur in the same species. The archaic form is probably that found in *Ceratonia siliqua* and *Cercis siliquastrum*, where the extra-fascicular system is localized in the epiderm; in other species it occurs in the hypoderm or in the cortex. The tannin or tannins are accompanied by an abundance of an albuminoid substance. The tanniferous cells are further characterized by the presence of threads of protoplasm connecting them with one another and with the elements of other systems of a different histological character. The author does not assign to these protoplasmic threads any function in connection with the distribution of nutritive substances.

Simian or Ape-like Man.—Prof. E. D. Cope, in the April number of the *Naturalist*, has an article on this subject. He says archæology, apart from anatomy, is a poor guide in the field of human ancestry. The closer association of man with the apes is based on various considerations. It is highly probable that the homo is descended from some form of anthropomorpha, either the Eocene lemuridæ or the simiadæ. He refers to the man of Spy to prove that there dwelt in Europe, during paleolithic times, a race of men which possessed a greater number of simioid characteristics than any which had been discovered elsewhere. The important discovery in the grotto of Spy of two skeletons, almost complete, served to unify knowledge of this race, which had previously rested on isolated fragments only. These skeletons proved what had been only surmised before, that the skeleton of Neanderthal, the lower jaw of Naulette, and the crania of Cronstadt belong to one and the same race. The simian characters of these parts of the skeleton are well known.

Cause of the Digestion of Albumen by the Leaves of Certain Plants.—N. Tischutkin published an article in 1889, in the *Berichte der Deutschen Botanischen Gesellschaft*, on the cause of the digestion of albumen by the leaves of *Pinguicula vulgaris* L., in which he endeavors to show that the process of digestion is the result of the action of bacteria. This is in opposition to the theory of Darwin and other authors that the digestion is analogous to the digestion by means of pepsin in the animal kingdom.

In an article in volume XII. of *Acta Horti Petropolitani* he further discusses the subject and draws the following conclusions:

1. The disintegration of albuminous compounds by the secretions of carnivorous plants is due to the growth of micro-organisms, principally bacteria.

2. Micro-organisms possessing the power of dissolving albuminous compounds always vegetate in the secretions of completely developed carnivorous plants.

3. The disintegration of the albumen does not commence at the moment of the secretion of the fluid, but only after micro-organisms have developed in sufficient numbers in the secretion.

4. The micro-organisms found on the leaves of carnivorous plants come principally from the air, though they may be derived from other sources.

5. The name "carnivorous" plants is to be understood in the sense that the plants only assimilate the products which the lower organisms have set free.

6. The role of the plant itself is only to furnish a medium in which certain micro-organisms may live and develop.

Production of the Perfume of Flowers.—The following conclusions are the result of the researches of Mr. E. Mesnard upon the method of production of the perfume of flowers:

1. The essential oil is generally found localized in the epidermic cells of the upper surface of the petals or sepals. It may exist on the two surfaces, especially if the floral parts are completely concealed in the bud. The lower surface generally contains tannin or pigments derived therefrom.

2. The chlorophyl seems in all cases to give rise to the essential oil.

3. The disengagement of the perfume of the flower is perceived only when the essential oil is sufficiently disengaged from the intermediate products that have given rise to it, and is found, in a manner, in a ratio inverse to the production of tannin and pigments in the flower.

This, says the author, would explain: (*a*) Why flowers with green petals have no odor; (*b*) why white or rose-colored flowers are, in most cases, odoriferous; (*c*) why the Compositæ, which are rich in tannin, have the disagreeable odor that they are so well known to possess; and (*d*) finally, why the cultivated white lilac and forced roses take on a finer perfume.

A New Preservative Fluid for Slugs.—After repeated trials to obtain a good preservative fluid for slugs, I have found the following to act so admirably in preserving the color, etc., that I think it would be well to place it on record, so that others may benefit by its use. Dissolve 10 grains of alum, 2½ grains of common salt, 1½ grains of potassium nitrate, 2 grains of arsenious acid and 2 grains of mercuric chloride in 5 ounces of distilled water, and filter. After well cleansing the slugs from mucus, I place them in tubes containing the above solution, and well seal with a mixture of five parts of *old* gutta-percha and four of asphalt applied hot, and obtain the best results.—*J. W. Williams, in Science Gossip.*

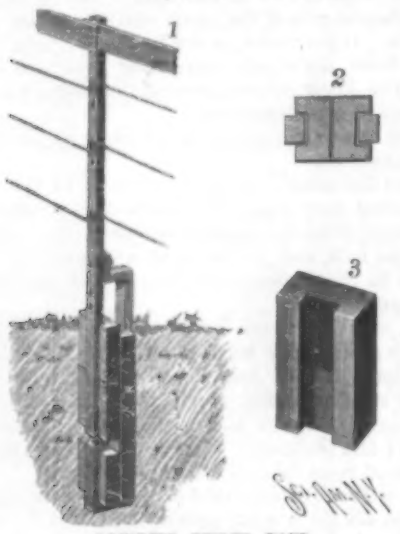
Preservation of Specimens of Fishes.—Up to recent years, the method of preservation most usually recommended to travelers for ichthyological collections, and, consequently, that most usually employed, has been the use of alcohol. But the numerous inconveniences that it presents, especially the generally high price of it at the proper degree of concentration, and the maneuvers that the use of it requires, are tending more and more to cause it to be renounced. Such renunciation is so much the more to be desired in that there can be recommended with confidence the use of a substance experimented with in his laboratory as long ago as 1884, by Mr. Leon Vaillant, professor of ichthyology at the museum, and also involuntarily by Mr. Chaffanjon, who, a few years ago, brought from the Orinoco a magnificent series of fishes. It is a solution of acetate of soda, which is used in the same way as fishermen use salt in the preservation of the codfish. In any sort of a vessel is spread a layer of the acetate, upon which are placed the fishes to be preserved. These are covered with another layer, upon which is placed a second layer of fish, and so on. This is all there is of the preparation. Prince Henri d'Orleans recently brought home a small collection of fish from Indo-China that had been prepared in this way. They arrived in a perfect state of preservation.

Flower Seeds for July.

In an article in the *American Agriculturist*, entitled "Flower Seeds to be Sown in July," Mr. C. L. Allen writes that if seeds of the perennial Delphiniums are now sown and protected from drying winds by lattice frames or light boughs, they will germinate quickly and make plants strong enough to withstand the winter. Pansy seed for autumn flowering might now be sown, although this will also need protection against the sun. If carried over in a frame during winter, the plants will be in the best possible condition for early spring flowering. The seed of the Oriental poppy should be sown as soon as they ripen, for they lose their vitality very quickly. The seedlings are difficult to transplant, and it is a good plan, therefore, to sow the seed where the plants are to remain, preferably among annuals, where the ground is not densely covered, as they root deeply, and the shade of the annuals will be rather a help than a hindrance to their growth. If hollyhock seeds are sown as soon as they are ripe in deep rich soil, the plants will bloom next year. All the Dianthus family, including hardy carnations and picotees, can be had in perfection next season if the seed is sown this month and the seedlings transferred when two inches high to the places where they are to bloom. Mignonette from seed now sown will make an admirable growth in the cool moist weather of September, and will give strong spikes of flowers in autumn. The seed of the white rocket candytuft sown this month will also make flowering plants in September, which will continue to bloom until frost.

AN IMPROVED FENCE POST.

A weighted metallic fence post with which both wire and board stretchers may be connected, or to which may be attached horizontal studding for paling fences, has been patented by Mr. James B. Gowdy, of Oak Grove, Ill., and is shown in the illustration, Fig. 1 showing the post in position in a fence, Fig. 2 being a sectional view through its lower portion, and Fig. 3 representing one of the weights used in anchoring the post. The post is of either wrought or cast iron, and all in one piece, the two parallel uprights of its lower



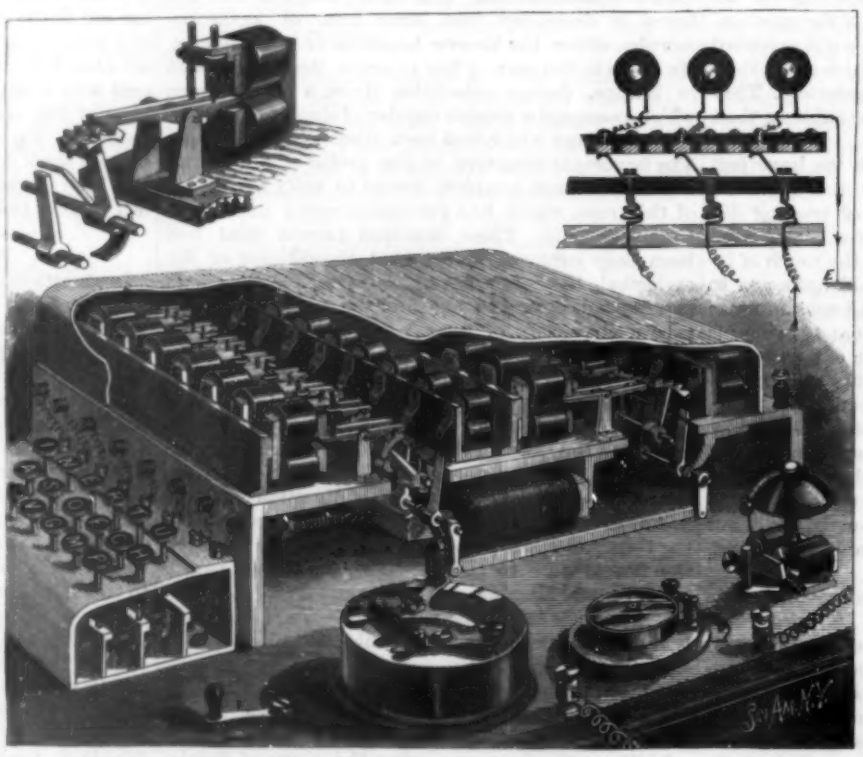
GOWDY'S FENCE POST.

portion forming a holder or receiver for specially formed bricks or weights, each of which has a groove in one face to enable them to be slid into place vertically, the bricks being arranged in couples, back to back. Where the post is made of wrought iron, the shorter upright is joined to the longer one by a bolt, and the brick-holding portion may then be spread slightly to receive the bricks before the bolt is tightened. A depression and bulge in the longer upright, just above the lowest bricks, is designed to prevent the sinking of the post too deep in the ground. The fence wires are locked to the post by staples inserted in holes provided for this purpose, board stretchers being similarly fastened by clinch or wire nails. With this improvement the post is designed to be so anchored to the ground that it will not be upheaved by the frost, and, on any disturbance of the earth, it will slide back as the ground settles.

A NEW PRINTING TELEGRAPH.

The illustration represents a printing telegraph apparatus designed, by means of a transmitting device with an ordinary keyboard, to operate at a distant station a typewriter, a type-setting machine, or other keyboard machine of the usual style, each station being provided with a similar apparatus. This improvement has been patented by Mr. Donald Murray, of the Sydney *Morning Herald*, Sydney, New South Wales, Australia. The apparatus is designed to use only ordinary telegraph currents, capable of being relayed and subject to all the conditions of ordinary telegraphy; to transmit eighty different characters; to work at the highest speed permitted by the manual dexterity of the operator at the keyboard, and to dispense with all clockwork controlling mechanism, synchronously moving type wheels, and other slow and cumbersome devices.

The apparatus comprises a transmitter, which, by the depression of a key, transmits a certain combination of five short positive and negative currents, and an interpreter, by the passage through which of a given combination of positive and negative currents a spring or lever is released and makes electrical contact, thus energizing a particular electro-magnet which operates a certain type key. Thirty-two transmitting elements connected in parallel form the transmitter, and thirty-two interpreting elements form the interpreter, and these are combined with a shift key device, shown in the right hand corner of the picture, a typewriter and a battery. The illustration represents the complete apparatus for one station—the transmitter, interpreter, shift key mechanism and typewriter—together with a main switch controlling the several circuits, a galvanometer which indicates whether or not a current is passing through the main line, and a signal bell.



MURRAY'S PRINTING TELEGRAPH.

The transmitter has a series of keys, as seen on the left in the picture, each key consisting of a rod operating a peculiarly constructed pole changer, and comprises a commutator having on one side parallel rows of stationary contacts connected in parallel with the line, and having a portion of the connections crossed, the commutator having its top surface inclined and its lower surface inclined at right angles to the inclination of the top surface, a key sliding adjacent to the commutator, and a contact block having a spring connection with the key-carrying contacts adapted to connect with a source of electricity, the contact block being arranged to move downward on one side of the commutator, and to slide inward and move upward so as to make contact with the contacts of the commutator. The interpreter, the detail of which is shown in the small figure, comprises a series of electro-magnets adapted to connect with a line, circuit-closing and swinging quadrants being arranged adjacent to the electro-magnets, and adapted when released to close the circuit through mechanism for printing a character or operating a key of a keyboard machine, each quadrant having a series of teeth in a different combination from the teeth of any other quadrant in the series. Swinging detents adapted to be actuated by the magnets engage the teeth of the quadrants, and electrically and automatically rotated shafts adapted to be set in motion by the closing of the circuit in which the quadrants are arranged carry mechanism to return the quadrants to locked position.

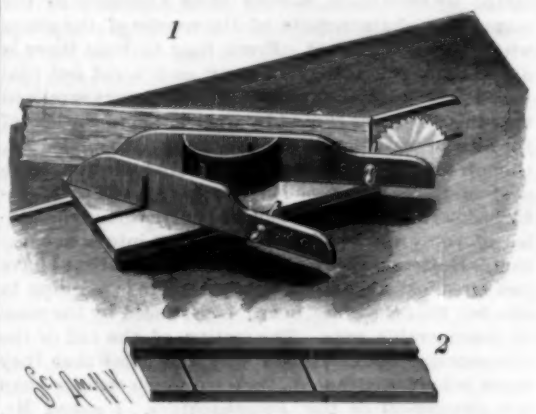
One of the transmitter keys operates the space key of the typewriter and three other transmitter keys operate the shift key mechanism, shifting to capitals, lower case or figures. When the paper carriage of the typewriter comes to the end of a line, it may be returned by the attendant at the receiving station or by an automatic mechanism provided for this purpose. The galvanometer on the main line at each station indicates when a current is passing. When the instruments are not in use the bells are put in circuit, and, when the interpreters are left in circuit, the operator at either station can send a message to the other station, where it will be recorded on the typewriter, without an attendant being present, the process being automatic, and it being necessary only to provide a sufficient amount of paper in the typewriter to receive the message.

A Clam Mine.

A clam mine, full of live clams and of great breadth and depth, has been discovered at the mouth of the Delaware Bay, off the Flashing Creek shore. This, says the *True American*, has proved a valuable find, and recently about 100 boats, containing from three to five men each, were at work on the mine. The product of the great bed is shipped daily to Chicago, a speculator of that city agreeing to take the entire output of the mine at about 30 cents per hundred, delivered at Bennett's Station on the West Jersey Railroad. Every now and then a discovery something like this is made, but the present mine exceeds any previous find known on the Atlantic coast. About three years are required for clams to grow properly and obtain a marketable size and flavor. This bed is said by experts to be about three years old. One of the greatest shipments yet made was on July 6, when over 50,000 clams started on their journey west from Bennett's Station. The bags were piled so high as to almost hide the station house.

A NOVEL WORK GUIDE FOR SAWS.

A guide applicable to any common form of saw table, to hold and guide the material to be sawed, and which is especially adapted to facilitate the quick and accurate forming of the pockets in the stiles of windows, is shown in position for use in Fig. 1 of the illustration, Fig. 2 being a broken detail view of one of the sash stiles with its usual angular cuts. This improvement has been patented by Mr. Valentine Stein, No. 180 East 109th Street, New York City. The guide consists of two parallel slide plates, separated by a slot, through which the saw passes, and adapted to be moved along over the bench top upon a guide rail removably secured therein, one of the slide plates having a groove fitting the rail. Extending diagonally



STEIN'S WORK GUIDE FOR SAWS.

across the plates at different angles are vertical wings, slotted to register with the slot of the slide plates, one of the wings having a guard to shield the hands of the sawyer from the saw, and the guard being likewise slotted to receive the saw. The wings support the stiles to be cut, and the stiles are held in proper adjustment, that they may be cut in the right place, by pins passed through holes in the wings. The different angles at which the wings are placed insures the corresponding cutting of the stiles, one cut being made with the stile against one wing and the other cut with the same stile against the opposite wing.

Palm Oil.

In a recent report on the botany of Sierra Leone, Mr. Scott Elliot says that the export of palm oil and kernels forms by far the largest part of the West African export trade. In 1890 the value of the palm oil exported from Sierra Leone was £13,599 and of the palm kernels £107,827. The tree is more abundant further down the West African coast, and appears to prefer alluvial, often marshy, ground near the sea. It particularly seems to thrive on the rich soil of the mangrove accumulations. There are large numbers of palm trees in the Mahela district, where a factory once existed, and there are also a considerable number up the Scarcies River and in the lower part of the Limba district. It grows also on low sandstone or gneissose hills, but probably does not produce so much in such places as on the low-lying, rich alluvials. The palm is propagated from the offshoots that appear at its base, and these are said to begin in the second or fifth year, and are in full bearing about the 10th to 15th year. They continue producing for 60 years. A single tree yields from one to three gallons of palm oil, or, according to Selmer, 16 liters annually, and this amount of oil will give from one-sixth to half a hundredweight of kernels. This would be a profit of from 2s. to 6s. a tree per annum, as about 300 gallons of palm oil give a ton of oil and about 2½ tons of kernels. Hence plantations of these trees should be profitable in time. It is, however, exceedingly difficult to get any trustworthy information, and the above, Mr. Elliot says, must be regarded as very approximate. The palms require no care, and are not, apparently, attacked by any injurious insects. The preparation is of a very rough and makeshift character; the fruits are thrown into a tank and left till decomposition begins. They are then boiled and afterward pounded in a mortar. Probably 25 per cent of the oil is lost in preparation.

MILK, when saturated with carbonic acid under pressure, will undergo no change within a week, according to C. Nourry and C. Michel (*Compt. Rend.*) If it is heated to 45–80°, the curds form as usual.

CHAIN TOWING BY MAGNETIC ADHESION.

In 1856, at the beginning of chain towing upon the Seine, the monopoly of the traction was reserved to the Bovet system. Tug towing was impossible upon our river. The works of canalization executed since that epoch have made of the Seine a first-class waterway of wide section, of great draught, of feeble current, and of easy navigation—all of which are elements that have reduced the advantages of chain towing to the profit of tugging, so well that to the first period of tranquil possession have succeeded the present period and all the difficulties of competition. As chain towing has an undoubted superiority in the ascent of the river so much the greater in proportion as the stream is wider, while tugging is under all circumstances preferable in the descent, it is necessary, in order to have as perfect a service as possible, to employ towing tugs with propellers or wheels provided with a towing apparatus serving only for the ascent and permitting of throwing the chain at any point of the trip.

This is how Mr. De Bovet justifies the necessity of the use of a chain towing tug:

A tug for towing boats through a submerged chain anchored at the up-stream extremity. The apparatus that permits of the boat being hauled consists of two windlasses with parallel grooves. The chain winds around these several times in going from one to the other, just like the rope upon the two grooved pulleys of a tackle block. A steam engine revolves these windlasses and the boat moves forward a distance equal to the length of the chain unwound. As the bearing point is fixed, the rendering of the whole is excellent, and such that the towing up-stream is always notably superior to that done by paddle-wheel or propeller tugs, and such superiority is more and more marked in measure as it is a question of rivers with rapider currents up to the moment when the current becomes so violent that the warping becomes materially impossible. On the contrary, in the descent, chain towboats are inferior to tugs, and become absolutely incapable of towing trains of boats if the current is rapid, for they cannot unwind their chain at all speeds, and, among other inconveniences, they risk running with less speed than the boats that they have in tow.

Returning to the case of an ascent, the essential condition of the operation is that there shall be no sliding between the chain and the towing apparatus; in a word, the towboat should no more slide upon the chain than the locomotive upon the rail, and the necessary adhesion, not being capable here of being demanded of the weight, is obtained through the angle of winding of the chain, which is from six to eight entire revolutions upon its drum. But, since it is very difficult to keep the grooves of the windlasses equal, any inequality is shown by excessive tension upon the intermediate lengths, and such that one has been able rightly to say of windlasses that they are apparatus to break the chain.

Moreover, the length of chain existing upon the windlass is great (about 40 meters upon the Seine towboats), so that the boat is in reality riveted to the chain, running backward and forward indefinitely, and exchanging, with more or less difficulty, its train with those that it meets with successively above and below its line of travel.

In fact, it can leave the chain only by unwinding it and dropping it into the water, thereby creating a slack of 40 meters at the point where the operation is performed, or by cutting it and carrying away the unwound portion—two methods that are incompatible, one of them with the security of the service and the other with the economy necessary for the maintenance of the chain.

If a boat could easily leave the chain at any point of its travel, it would suffice to provide it with a propeller, in order that it might redescend in free course with a train, and in order that it might become possible, in thereby having a two-way service with a single chain, to greatly improve the conditions of exploitation of the towing companies. The solution depends upon a system of impulsion by the chain that permits of the construction and putting in service of a boat capable of acting, as need be, either as a chain towboat or a tug.

Fig. 2 shows the essential arrangements of the old system of chain adopted at the origin by the Company of the Lower Seine and of the Oise, and universally adopted in France and foreign countries. It consists of two five-grooved drums with parallel axes, 3 meters apart, around which the chain winds a sufficient number of times (generally four half revolutions upon each drum) to have the adhesion balance the necessary tractive stress. The length of chain wound on is 37 meters, which does not permit, as may be seen, of throwing the chain at the end of the passage up-stream and of running by propeller down-stream.

It seemed to Mr. De Bovet that the solution ought to be sought for in the use of a single drag pulley, upon which the chain would make but a fraction of a revolution, and having quite a small diameter, so as not to lead to too reduced an angular velocity, necessitating parts of excessive dimensions. The necessary adhesion has been sought for in the electric current, in making it magnetize a pulley in the groove of which the chain passes. The results of the preliminary trials were sufficiently conclusive to decide the Towing Company of the Lower Seine and of the Oise to have a new towboat, the Ampere, constructed (Figs. 1 and 4), in which the towing apparatus has been replaced by a magnetized pulley, which, with three-quarters of a revolution only and 3 meters of chain (Fig. 3), develops a sufficient adhesion, is easily placed and removed, and is infinitely less exposed to wear and deterioration than the chains upon ordinary windlasses.

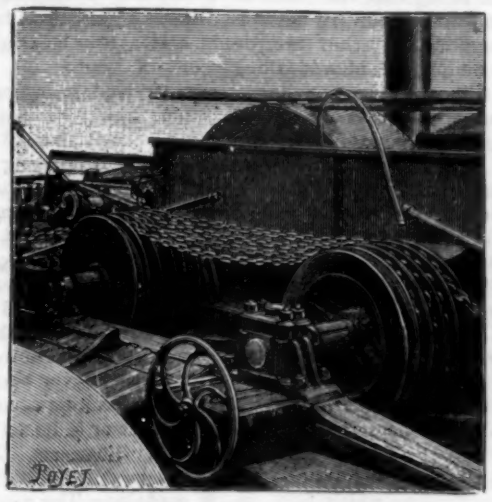


Fig. 2.—ARRANGEMENT OF THE CHAIN AND WINDLASSES OF AN ORDINARY CHAIN TOWBOAT.

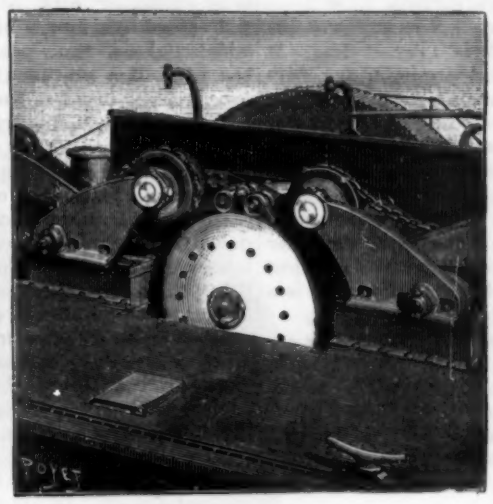


Fig. 3.—BOVET'S ELECTRO-MAGNETIC ARRANGEMENT.

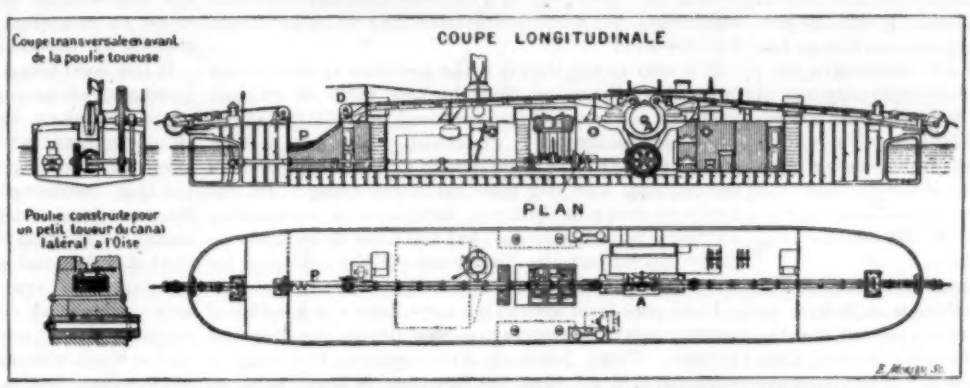


Fig. 4.—MECHANISM OF CHAIN TOWBOAT WITH MAGNETIC ADHESION.

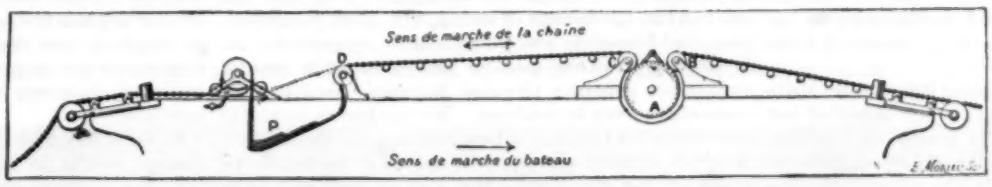


Fig. 5.—DETAILS OF THE ARRANGEMENT OF THE CHAIN.

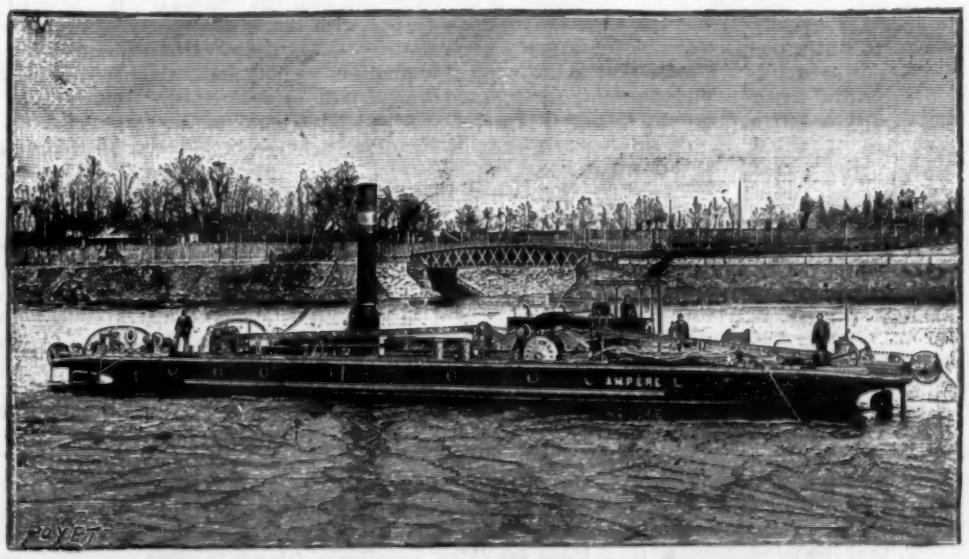


Fig. 1.—THE AMPERE, THE FIRST CHAIN TOWBOAT WITH MAGNETIC ADHESION.

This towboat, constructed by Mr. Satre, at Lyons, is 33 meters in length, 5 in width, and 2·7 in depth, and has a mean draught of 1·9 meters while running as a chain towboat. Fig. 1 gives a general view and Fig. 4 a section and plan to a scale of 3·3 millimeters per meter ($\frac{1}{300}$). Its engine, of the compound vertical type, placed nearly amidships, is capable, through two gearings, of directly actuating the screw, if need be, in developing 150 horse power at 150 revolutions per minute, or the towing apparatus, through bevel wheels, in developing from 60 to 80 horse power at 90 revolutions per minute. The chain, entering at the bow, passes over the towing pulley, A (Figs. 4 and 5), and is guided at the entrance by a roller, B, of non-magnetic metal. It passes, at its exit, over a massive roller, C, of magnetic metal, in order that, at this point, if the roller is brought into contact, it may give to the flux of force an easier passage than that offered by the chain, and that the latter, serving no longer to close the circuit, may more easily detach itself under the action of a very feeble tension of the hind length of the chain.

A tappet of non-magnetic metal is arranged above the pulley, so as to assure a detachment in all cases, by completing, if need be, the action of the roller, C, in case of running forward, which is the rule, and by acting alone in case of running backward. This last is very exceptional, and occurs only in case of maneuvers corresponding to very feeble tractive stresses upon the chain—so feeble that they can be realized with a very slight magnetization of the pulley, A.

It is necessary for a towboat moving upon a chain always in the same direction, in ascending the stream, to be able to act upon the evacuation of the chain astern, so as to allow it at moments to pay out now a little more and now a little less than it enters through the bow. For this purpose there is needed upon the deck a chain well, P, placed behind the towing apparatus and provided with a brake that permits of regulating the out-pay, of holding it where there is enough slack, and of letting it out where there is too much tension. The chain well being at P, the brake at the exit has been formed of a magnetized pulley, similar to the towing pulley, but smaller, the brake stress being much inferior to the tractive. When the current is

sent into it, the chain adheres to the upper part. A block, movable around a horizontal axis, balanced to such a degree as may be desired, bears against the lower part of the pulley and prevents it from revolving. The effect is reversed by varying the current.

At D is a roller, which, through simple friction, if a rotary motion be given to it, is capable of aiding in the out-pay of the chain at moments in which there would be too great a slack astern and in which the brake would operate. This roller, D, is actuated by a small dynamo, which is the simplest method of throwing into and out of gear at a distance when one has at his disposal, as is the case, an electric current.

When the chain is slightly slack, the action of the roller, C, is insufficient to produce a detachment. It is, therefore, of interest to increase the impulsive effect of the roller, D, which then operates continually, and the adhesion of which is regulated by constructing it like the principal magnetic pulley, and by supplying it through a special derivation taken from the common generating dynamo.

Another dynamo, situated in the engine room, actuates a centrifugal pump for the maneuver of the water ballast compartments, which are so arranged as to put the boat in different lines of water, according as it is a question of a tug or of a chain towboat.

All the maneuvers interesting the chain *en route* are reduced to the manipulation of three commutators corresponding to the three magnetized pulleys. As the adhesion is a function of the intensity of the current, there will be a sliding every time the tractive stress exceeds the adhesion. The power exerted will, therefore, be automatically limited, and any breakage of the chain be thus rendered impossible.

Such are the principal arrangements of the towage system carried out by Mr. De Bovet upon the Ampere. This, however, is not the only application to which electro-magnetic adhesion lends itself. It will be possible to utilize it in the gearing of engines and in the application of brakes to railway and street cars, etc.; but we have wished at present to describe only one of the most ingenious applications sanctioned by experiment, and on the eve of the introduction of a revolution into the present processes of chain towing upon canalized rivers.—*La Nature.*

The Physical Power of Mind.

DR. KARL MULLER.

It was said by Kant that a man need not sneeze against his will. We have no evidence as to how far he verified the proposition in his own person, but the expression has its significance, showing us that Kant regarded the will as a sort of regulator, if not the absolute, controlling power in the individual Ego. Properly speaking, he regarded body and spirit as interdependent—inseparable. Mind and matter were in his eyes a unity in which the action of the one called forth the reaction of the other.

We have no intention of reopening here the old strife between materialism and idealism. The object of our introductory remarks is simply to present the subject in its highest aspect, where it naturally suggests the question: By what means is this interdependence between the physical and spiritual brought about? Turn and twist as we may, we can suggest no other medium than our nerves, those innumerable agents in equally innumerable labors. Every impression to which our body is subjected produces a local stimulus or excitation, which is at once telegraphed to the central organ of our spiritual being, the brain, by one of these active agents. The sensation arises into consciousness, and in such wise that we are able to locate the seat of stimulation; the central organ reacts, and, in the case of a painful shock, for example, messages go to the heart, which is violently excited, thereby influencing the whole circulation, possibly making the knees tremble. Now, what is terror? Certainly nothing bodily, but a mere mental condition, and yet it may be sufficient to exercise the most powerful influence over any of our organs, even to paralyze them. How this occurs we know no more than we know how consciousness originates. It presents, however, a sufficient illustration of the fact that a disturbed mental condition can operate prejudicially to our physical constitution. That sudden joy, under certain circumstances, may equally prostrate the physical powers, proves only that extremes may produce like consequences.

What does this teach us? This only, that the mind is a power in our physical constitution, as great a power, perhaps, as even the heart or the lungs, if not a greater. Its special media are our senses, which, receiving impressions of stimuli, transmit them to the central organ, where they engender characteristic mental conditions. How must the eye be exercised in mastering all the impressions that fall upon it from the outer world! According as they are beautiful or ugly, they impress our mind pleasantly or painfully, and by its reaction our bodies are similarly affected. In the one case we may be disposed to dance, in the other we may be incapable of even eating or drinking. Similar effects may be produced through the organ of hearing. Word and tone are capable of generating the most powerful emotions. Music especially exercises an immeasurable influence on even the simplest minds. Lively music impels people irresistibly to dance. The power is purely spiritual, but it reacts in the highest degree upon the body.

So, too, with the spoken word. Is it not wonderful how we are moved to anger or sympathy, how we may be exhilarated or depressed, by the mere modulation of another's voice, or by the narration of tales of humor, of pathos, or of horror? Of course ideas are awakened, but what power is there in ideas to make the hair stand on end, or the sweat ooze from the pores of the skin, or how can a thought make us dizzy? It is no satisfactory explanation to say that the dizziness was caused by a flow of blood to the head. What is it which makes so many people giddy when they stand on the edge of a precipice? Simply the idea of falling over. Every one familiar with the sensation knows that it feels as if his brain were the seat of confused emotions, which entirely upset his equanimity. But what causes the sensation? I have seen a mountain maid stand on the outer edge of the witches' dancing place in the Hartz, and let her eye wander calmly down the dark valley below, and I saw the same girl later overcome with dizziness while crossing a bridge, below which the waters seethed and whirled tumultuously. A strong will can do much, if not everything, to overcome this sensation of giddiness, which, if it arises, excludes all the more pleasurable ideas which the scene is equally capable of awakening.

The most powerful influence on our lives is unquestionably love; but this, too, is based on stimulus-sensations precisely as the poet says, "Thy beautiful figure excites me" (*Mich reizt deine schone Gestalt*). It originates in the pleasurable emotions which each inspires in the other; but what fateful revolutions, spiritual and physical, may it not work, whether in a joyous or tragical direction. It is the most spiritual of human sentiments, yet what devastation may an unfortunate love involve!

It is easy to say that it is the nervous system whose molecules vibrate at their highest ratio in tranquil love, but are arrested and confused in their vibrations when the sentiment is disturbed. But how is that brought about? Is there really a boundary between the physical and the spiritual in our being? In this realm we grope in darkness, incapable of recognizing anything but phenomena, but the more thoroughly we study the subject, the clearer appear the evidences for the conclusion that body and soul are one.

If we pass from love to hate, we have a new series of occurrences which operate powerfully on our physical nature. From jealousy to vengeance the road is straight, and all that lies between is blind passion. Why do we say blind? Because that is the actual condition which the mental life manifests. Not that the eye has lost the faculty of seeing, but that judgment, love, and humanity are overwhelmed by passion. As is well known to the medical profession, such mental excitations generate physical ailments, resulting, in some cases, even in madness. No one knows so well as the doctor for the insane how intimate is the relation between insanity and physical disease of the brain. To a doctor for the insane the idea of soul and body existing apart is simply ridiculous; but he would probably listen respectfully to the suggestion that the soul is not one with the brain only, but with the whole body.

Passing now to the realm of hypnotism, we find one mind influencing another, and through it the associated organism, by purely physical agencies. This, perhaps, affords the key to the tendency to yawn, laugh, cry, etc., in sympathy with others.

We must conclude, then, that body and soul constitute a unity, in which the healthy activity of each is essential to the healthy activity of both. The moral is that for a healthy enjoyment of life it is necessary to exercise the mental powers to a normal extent, and maintain a rigid control over the passions. Mental and physical health and vigor call for activity, apportionment of time, regularity of life, education of the will power for the attainable and natural, and the pursuit of truth, goodness, and beauty.—*Die Natur, Lit. Digest.*

The Value of Camphor.

Just at present, when the profession is carried away by enthusiasm for new drugs, it is well for us to remember that there are older remedies which are in danger of passing into obscurity. Not that the latter are unworthy of professional esteem, but owing to the fact that they have been crowded out by many new drugs, for which so much has been claimed, and which have undoubtedly, in many instances, deserved the credit which they have achieved. Frequently those of us who constantly employ the newer remedies find that they fail to produce the desired results, and are surprised, when at last we employ old friends, that we get results which, if produced by the newer drugs, would lead us to be enthusiastic in their praise.

One of the drugs which seems to be in danger of being lost to the profession in the treatment of a number of serious ailments is camphor. Forty or fifty years ago its use as a diffusible stimulant and nervous sedative was widespread, and the best practitioners regarded it as a sheet anchor in the treatment of many diseases which tried their skill to the utmost. Thus no less an observer than the celebrated Dr. Graves believed that camphor was a very valuable drug when used as a diffusible stimulant in the treatment of those adynamic affections which find their type in typhus or typhoid fever. Under these circumstances it is to be administered frequently for days at a time, and, if the records can be believed, produces a condition of nervous quiet without depression which is of singular value to the patient. At the same time it seems rather to improve the digestion than to disorder it, exercises a distinct antiseptic influence over the stomach and bowel, and acts as a carminative or prevents the development of tympanites. Similarly, in cases of croupous or cartarrhal pneumonia, in which the patient's condition rapidly becomes asthenic, camphor proves of very marked benefit in quieting the restlessness, frequently decreasing or stopping the delirium, and exercising that peculiar influence, which seems to be inherent in some drugs, of producing a condition of general improvement which we are able to recognize, and yet which the most experienced physician is unable to explain. Because of its volatility it is naturally rapidly absorbed, and equally rapidly eliminated, and when administered should be given, under these circumstances, in most instances at least, every six hours. In typhoid fever which is complicated by diarrhea, camphor is undoubtedly one of our most useful medicaments, nor is its action limited only to the diarrhea of sthenic diseases. The popularity of paregoric has been largely won by the activity of the camphor which it contains. The recollection that all volatile oils, of which, for therapeutic purposes, camphor is one, tend very distinctly to prevent a serious outpouring into the intestine, at once indicates that camphor, either alone or combined with other drugs, is a valuable remedy for diarrhea.

It has been found in various portions of Europe, in a number of cholera epidemics, that camphor exercises its properties as an anti-diarrhea remedy and as a diffusible stimulant with singular efficiency. It has been given by dissolving it in absolute alcohol, and then adding this absolute alcohol to ordinary red wine. This treatment was nearly always followed by expressions of satisfaction upon the part of the patients, who stated that it prevented nausea, overcame their depression, relieved the cramps in the bowels and in the extremities, and by its warmth did much toward making them more comfortable. Its employment under these circumstances, though entirely empirical at the time, has more recently been proved to be a proceeding based upon rational grounds, and those who have read the Progress columns of the *Gazette* during the last few months will recollect several items in which it was shown that volatile oils and their derivatives act as intestinal antiseptics, and that red wine very distinctly inhibits the growth of the cholera spirillum.

In cases in which functional disorder of the nervous system results in cardiac palpitation or irritability with the production of attacks of anxiety rather than of true heart-pang, and in which the patient complains of a fluttering or sinking feeling in the præcordium, the spirits of camphor will give results almost equal to those obtained by the use of that harmless but very valuable remedy, Hoffmann's anodyne. Not only is this true, but in cases of dilatation of the heart associated with emphysema, chronic bronchitis, or true bronchorrhea, camphor will often give relief from the cough and the cardiac embarrassment without decreasing expectoration to such an extent as to permit secretions to accumulate in dangerous quantities.

Nor does the value of camphor as a therapeutic agent rest upon its value in internal medicine. In some cases of rheumatism, involving the joints or the sheaths of the muscles, camphor lotions are too frequently employed with success to permit us to doubt of its efficiency, and its influence upon the nasal mucous membrane in the early stages of acute coryza is undoubtedly worthy of praise.

We should not forget the recommendation, first made, we believe, by Drs. Ringer and Tilt, that camphor dissolved in cologne water or alcohol should be applied to the vertex in those peculiar cases of reflex uterine headache occurring at the menopause or at each menstrual epoch. In those cases of uric acid diathesis in which there develop multiple or single spots of hyperesthesia in the scalp, which are discovered by the patient either through the neuralgic pain which he experiences, or in brushing or combing the hair, camphor as a lotion will frequently relieve the tenderness.

It may seem unnecessary to call the attention to these well-known therapeutic points, and doubtless there are many of our readers who use the drug in combating these conditions in their daily practice. As we have stated, we believe that camphor is not used sufficiently, and it is with the object of increasing its general employment, and not with the idea of bringing foward any new points in its usefulness, that this article has been written.—*Therapeutic Gazette.*

FONTHILL ABBEY.

We present herewith a view of the west and north fronts of Fonthill Abbey, a remarkable building which once existed between Shaftesbury and Salisbury, in Wiltshire, England. Before describing the house a short account of its remarkable builder may prove interesting. William Beckford was born in 1759 and was the son of the fearless Alderman Beckford, who presented a protest to the King in defiance of all precedent. During his minority young Beckford was carefully educated, and studied music under Mozart; he traveled extensively, and when only twenty-two he wrote one of the most remarkable works of the imagination ever produced. This was the "History of the Caliph Vathek," somewhat in the vein of the Arabian Nights. "Vathek" was written at one sitting of three days and two nights and in French.

Beckford's fortune was immense; besides £1,000,000 in ready cash he had an income from estates in Jamaica which amounted annually to £100,000. Beckford soon got the building mania and spent £250,000 on Fonthill Abbey.

The building was begun for Mr. Beckford in 1796 by Wyatt, who did so much to ruin the English cathedrals by so-called restorations. The general arrangement was to be that of a convent with cloister, so the form of a true Latin cross was selected for a ground plan. Its external characteristics were to be those of a convent partly in ruins and partly perfect; probably nothing could be more happy than this idea which the architect laid before his patron, and it was perhaps to the very excellence of the original design that we may ascribe the cause of its not being carried into execution. The plans were modified until much of the original idea was lost and a great deal of the purity of the design was sacrificed. Permanence did not seem to be thought of, and timber and cement usurped the place of stone. Work was kept up day and night, and when the tower reached the height of three hundred feet it was blown over by the wind acting on a large flag fastened to the summit. The only regret expressed by Beckford was that he had not witnessed its destruction. A new tower was immediately begun and was built of stone. The building from its shape was a very uncomfortable one to live in, and some of the rooms could not be properly warmed. The rooms were magnificently decorated and all the furniture, like the building itself, was Gothic. The ceilings were covered with most beautiful tracery and the windows were filled with exquisite stained glass, and here in almost regal state lived the wealthy commoner, who was never so happy as when in his library.

The great central tower rose to a height of three hundred feet. The plan of the tower was octagonal with angle buttresses. The tower rose in five stories and was surmounted with an embattled and perforated parapet, above which ascended the tapering forms of the pinnacles, decorated with crockets and finials and bound together by a cradling of iron. Beckford lost a large portion of his property owing to a flaw in the title to his Jamaica estates, the domain of Fonthill was sold, and he removed to Bath; he died in 1844. Beckford frequently ascended a tower in Bath and looked through a telescope at the tower of his former residence. It is said that one day as he was looking at the tower it suddenly vanished. Beckford spread the report that the tower had fallen, which was confirmed the next day, for the foundations were weak and the tower had again fallen on the lath and plaster convent. Hardly a vestige of the original abbey remains, and the site is occupied by a modern house. Our illustration is taken fron a rare work entitled "Delineations of Fonthill and its Abbey," by J. Rutter, Shaftesbury, 1823.

THE STEARIC MOTOR.

The little motor represented herewith operates not by steam nor by electricity nor by compressed air. It

THE STEARINE MOTOR.

possesses no boiler, no cylinder, no piston, and consists simply of a stearine candle. Let the reader take a candle and perform the experiment for himself. Insert in the center of the candle, and at right angles with it, the heads of two pins previously heated. These pins will constitute the axis of the motor, and are to be placed upon the edge of two wineglasses.

If the two ends of the candles are lighted, they will burn and a drop of stearine will fall into one of the plates placed beneath in order to receive it. The equilibrium of the scale beam will be broken and the other end of the candle will descend, causing the end that has just lost the first drop of stearine to rise. This oscillatory motion will cause several drops to fall from the end that has just descended, and which, in its turn, becomes the lighter, and will, therefore, rise while the other descends, and the oscillatory motion, slight at first, will take on a greater and greater amplitude, the candle, slightly inclined upon the horizon at first, finally taking a nearly vertical position.

There is nothing more interesting than to watch this oscillatory motion, which does not cease unless one blows out the two flames or the two candles are entirely consumed; that is to say, at the end of half an hour.

If, now, it is desired to utilize the motion of the candle while it is in operation, it may be connected by a thin iron wire with small figures cut out of cardboard and jointed, to which it will give a to-and-fro motion. It may be considered as the walking beam of a Watt engine, and to each extremity may be connected a small piston moving in a vertical cylinder. Finally, and more simply, there may be fixed to the axis, by means of pins (which will keep it at a distance, in order to prevent the contact of the flames), a strip of light cardboard representing a plank, to the extremities of which may be glued two figures that will play at see-saw, and thus render the experiment still more attractive to the young.

Albinism Among Animals.

A correspondent writing from Norwich, Conn., to one of our daily papers calls attention to several rather remarkable instances of albinism recently observed among the lower animals. This season, he says, an unusually large number of albino birds have been seen in eastern Connecticut. A day or two ago three milk-white young robins flitted about in the trees of the Congregational church yard, at Stonington. Some persons who doubted at first that the birds were robins became convinced when a pair of mature natural-hued robins, putting in an appearance, took charge of the freaks, and coaxed them away from the neighborhood of a curious crowd that had gathered there. The little fellows were only just learning to fly, and two of the Stonington citizens finally captured and caged them. The birds are said to be getting on well in captivity. Two albino "red" squirrels were seen in the outskirts of Norwich about a fortnight ago. Abram I. Kinne, a farmer of East Plymouth, discovered recently a perfectly white crow in a nest of other normal little ones, which was built in an oak in the woods near his house. He has domesticated the queer bird.

A FLAT car costs about $380, a flat bottom coal car $475, a gondola drop bottom $500, a double hopper bottom coke car $540, a box car $600, a stock car $550, a fruit car (ventilated) $700 and a refrigerator car $800. A four-wheeled caboose costs $550, and an eight-wheeled one $700. The prices given on the above cars include power brakes and vertical plane couplers. A 50 foot mail and baggage car costs $3,500, a second-class coach $4,800, a first-class coach $5,500, while a first-class Pullman car costs $15,000.

FONTHILL ABBEY—ERECTED AS A RESIDENCE, IN 1796, BY WILLIAM BECKFORD.

RECENTLY PATENTED INVENTIONS.

Engineering.

FURNACE.—John T. Jenkins, Massillon, Ohio. A gas inlet leading to the combustion chamber of this furnace has checker brick outside the chamber to spread the gas, the gas inlet being substantially horizontal where it connects with the combustion chamber, and there being a series of jet openings for discharging hot air into the chamber above the gas inlet. When the furnace is started the gas and air are admitted in proper proportions, increasing according to the heat in the chamber until the desired temperature is reached, the gas and the air blast issuing from the jets striking each other a short distance from the bridge wall, so that the heat will expand in the combustion chamber and in the working chamber or hearth.

RELIEF VALVE.—Andrew L. Harrison, Wilmington, N. C. This is an improvement more especially designed for use on air pumps of condensing engines, to insure an easy seating of the inlet and outlet valves to prevent excessive wear of the valves and the lining in the air pump. The invention consists of one or more air valves for the water delivery valve to permit the escape of air previous to and separate from the discharge of the water through the water delivery valve.

Railway Appliances.

HOPPER BOTTOM CAR.—Richard Blackstone, Central City, South Dakota. This invention relates to drop bottom cars for carrying coal, ore, etc., and provides for the protection of the door-suspending chains from the material loaded in the car, thus permitting an easy opening of the drop bottoms. In the car is a chain-guiding tube having at its upper end a flange for attachment to the housing of the chain beam, the lower end of the tube being bent to conform to the side flooring of the car, while a roller in the lower end of the tube guides the entrance of the chain.

CAR COUPLING.—Frank Vaughan, of Elizabeth City, N. C. This coupler comprises two balls connected by a chain or rod, there being openings in the balls to receive a pin. In the drawheads are mortises to receive the balls, the mortises being open at the top to permit the ball to drop in, and having apertures leading to the front for the chain or rod connections. A ball holder has a pivoted arm or portion provided with a cup ball receiver in which is a central pin adapted to enter the opening in a ball, the receiver oscillating from the position in which it retains the ball to that from which it will release the ball. When the drawheads meet and are retracted the ball receiver tilts to drop the ball into the approaching drawhead and complete the coupling. For uncoupling, a special device is provided for readily lifting the ball out of the drawhead.

Electrical.

ELECTRIC RAILWAY.—J. A. Folsom, Minneapolis, Minn. The improvement for which this inventor has obtained a patent is applicable equally in an overhead or an underground conduit system. The invention provides for carrying the line wire in a conduit made of insulating material, and also adapted to carry the feed wires, one wall of the conduit being made of leather, sheet rubber, or other flexible material yieldingly held; through this wall extend the supports of a trolley conductor, held normally out of contact with the line wire, but forced into contact therewith, to make the circuit, by the passage of the trolley. The improvement affords complete protection to the line wire and feed wires, obviating all danger from contact with electric light, telegraph and other wires, and prevents waste of current.

Mechanical.

JACQUARD LOOM MECHANISM.—Frank Charcot, Paterson, N. J. To greatly increase the efficiency of the Jacquard loom, and lessen the wear and tear on the loom harness, have been the objects of this inventor. The invention consists principally of a stationary grate, and two griffs mounted to slide toward and from each other in such a manner that the upper movable griff moves the hooks in engagement with the stationary grate, and the lower movable griff receives the hook from the grate and moves it downward to lower the corresponding heddles. The invention covers novel details and combinations of parts and the construction is simple and durable.

WRENCH AND WHEEL LIFTER.—James Robertson, Perth, Canada. This is a combination tool consisting of an arched frame having a bearing member at its outer end, a spindle projected inward from its opposite end and having an outwardly extending handle which has a transverse socket-like bearing in which is journaled a rotary wrench mechanism, including nut clamp members. The device is more especially designed for removing axle nuts and lifting the wheels of vehicles when the axle is to be lubricated.

Agricultural.

CULTIVATOR.—Clyde T. Eldredge, Kirkwood, Ohio. This invention provides means by which the plow or cultivator beam may be carried either to the right or left and will remain in the position in which it is placed, there being no strain on the operator following or attending to the shifting of the beams. In connection with each beam is a balance spring, holding the beam in the position in which it is placed, and counteracting its tendency to move again to the center line. The spring is simple and durable, and its construction is such that it may be readily applied to any cultivator, and will act the moment the beam is carried to the slightest extent either to the right or left.

COTTON PLANTER.—Leonidas M. Rhodes, Warrenton, Ga. This machine comprises a wheel-supported frame on which is a hopper adjustable in relation to the wheel, a sleeve with a hub inclosing and being adapted to be locked on the wheel shaft, on which is a head in contact with the sleeve. A furrow opener is attached to the forward end of the beam, and as the planter is pushed along by hand its wheel keeps the seed constantly agitated, the construction being such that the seed may be dropped in greater or less quantities as desired. The invention is an improvement upon a former patented invention of the same inventor.

HAY OR HOG RACK.—William H. Long, Washington, Ill. This is an improvement in hay wagons with hinged skeleton sides for adjustment from an inclined to a vertical position to adapt the wagon for transporting small stock, as swine, sheep and calves. A side rack is supported on the side beams and has a flexible or hinge connection with a device adapted to slide through the bed, the device having a stop plate which comes in contact with the bed when the rack is inclined outward.

Miscellaneous.

WATER COOLER.—Edward T. Green, New York City. This cooler has a central ice chamber entirely separate from a hermetically sealed water-holding portion, a peculiarly constructed valved funnel being used to fill the cooler with boiling hot filtered water. At one side of the cooler is an attached vessel partially filled with a liquid disinfectant, and as the water cools, creating a vacuum in the top of the cooler, air is drawn in through a pipe extending from the outside into the disinfectant, through which it bubbles up and passes into the top of the cooler, so that no possible contamination of the water can take place either by ice or rain.

BEDSTEAD.—John J. Dugan, Salem, Oregon. The end and footboards of this bedstead are each formed of a single piece of bent pipe, and the side boards are connected to them by T couplings, while angle irons connect the head posts and foot posts by means of angle irons terminating in end straps bolted to the couplings. The bedstead is especially adapted for use in prisons, etc., and has but few parts strongly put together, there being no legs or other pieces which can be wrenched off and used as weapons.

BOOKBINDER.—Nathan D. Wolfard, Hartsville, Ind. This is an improved device for binding into book form pamphlets, periodicals, manuscripts, etc., and comprises binding strips of sheet metal, each sheet doubled upon itself to form a fold in which a section may be held, while outwardly extending flaps are perforated to receive connecting devices, which are preferably ring-like pieces of wire, by which the sections are held together.

SUPPLY AND WASTE PIPE.—William A. Eberhart, Asbury Park, N. J. This invention provides a simple sanitary and convenient arrangement of pipes and valves by which one orifice in a fixture may be used for the inlet, outlet and overflow, the construction and arrangement of the pipes being such that no waste water can possibly stand in them. The system of pipes is designed to be easily controlled and afford a perfectly clean water supply and perfect drainage.

LUMBER TRUCK.—Howard Daniels, Atlanta, Ga. Two patents have been granted this inventor for a truck for use in connection with his patented lumber piling machine. The truck has tilting stake sockets at each end adapted to receive the end stakes, means for tilting the sockets to incline the entire load, and self-adjusting compensating boards attached to the stakes to take up any space that might be left between the last tier of boards and the end stakes. The lumber can be piled upon the truck upon edge or vertically, instead of flat or horizontally, enabling one to pile larger loads upon the truck and insuring vertical draught passages through the pile. The truck may be quickly and easily unloaded without going on top of the pile. The second invention provides a simpler construction of stake sockets, strengthening also the entire truck, a rigid socket receiving the stake and a locking device holding it normally in a vertical position, the locking device being thrown back to permit the tilting of the stake as desired.

LUMBER PILING MACHINE.—This is another invention of the same inventor, and the machine has an intermittently swinging conveyor frame to which boards are delivered by an inclined feed chute, a rocking catch lever holding the courses in position, and the frame being operated by intermittent pinion, clutch and cam-engaged lever. The machine piles lumber upon edge as it comes from the mill, on trucks, to be carried to the drying kiln, distributing the spacing strips between each course of lumber, making air passages for the entire height of the pile.

WAGON OR CART.—William C. Read and Ben Hager, Salt Lake City, Utah Ter. A vehicle for carrying melted asphaltum and other substances which need to be kept warm or hot to remain properly fluid is provided by this invention. The wagon or cart body has double sides, ends and bottom, affording a water space surrounding the wagon body, and connected with a pendent water drum, below which is a burner connected by a pipe with an oil reservoir on one end of the wagon. The water reservoir is provided with a vent cock, and with a water and steam gauge and pop cock.

VEHICLE RUNNING GEAR.—Johann Urbanek, Frankfort-on-the-Main, Germany. According to this invention rearwardly extending frames carrying at their lower ends small accessory wheels are pivoted beneath the vehicle, radius bars extending downward from the vehicle adjacent to the frames, and draught traces connecting with the axles of the vehicles and with the radius bars. The improvement forms an attachment which may be applied to carts and other vehicles to enable the wheels to pass readily over stones and other obstacles, the meeting of such obstructions throwing the draught on the accessory wheels to lift the main wheels over the obstructions.

WHEEL.—Herman E. Kuhner, Davenport, Iowa. This wheel is formed of two flanged sections, one of which has radially extending spoke sockets open at one side and adapted to be closed after the spokes have been inserted. A strong, cheap and durable metallic wheel may thus be made, suitable especially for use on agricultural machines, and one which can be easily put together and taken apart.

STREET SPRINKLER.—Charles A. Clark, Portland, Oregon. This invention provides a stationary system of sprinkling which shall be a fixture in the streets. It comprises a series of pipes laid below the surface, and connected with perforated sprinklers or spray nozzles at the street surface, protected by hinged guard plates, which are thrown back before the water for sprinkling is turned on.

PNEUMATIC TIRE.—George Pickel, Berlin, Germany. An improved valve for the inflation of the tubes of pneumatic tires has been designed by this inventor, the valve keeping the tube tightly closed when it is inflated, to prevent leakage, and providing for readily and rapidly emptying the tube when desired. A transverse rotatable plug fits in an aperture of the inflating tube, the plug having a transverse and a longitudinal bore, and a valve freely movable in the transverse bore, while a pressure gauge communicates with the longitudinal bore, the plug having a shoulder forming a seat for the valve.

HARNESS.—Isaac N. Darr, Monticello, Ill. This is a light and simple harness especially adapted for use on trotting horses. The saddle consists of two straps, one behind the other, each provided with belly girths, and the rear one serving as a surcingle, a thill strap extending forward for connection with the front end of the thill, and a trace strap extending rearward to connect with the thill or whiffletree. The harness may be used in connection with the ordinary bridle, but the breast plate or collar, the usual breeching, and the customary traces are dispensed with.

HORSESHOE.—David Gingold, New York City. This shoe has a central sole or guard plate, a semi-elliptical toe piece, a transverse heel piece, and transverse ribs between the toe and heel piece, filling material of cork, rubber, leather, or other substance, being held between the ribs and between the ribs and the toe and heel pieces. The shoe is designed to be perfectly balanced, to prevent the horse from slipping, to guard the hoof and prevent the picking up of nails, etc.

BRIDLE BIT.—Will C. Wittmann, Lincoln, Neb. In this bit the cheek rings are fitted to slide on the mouth bar to engage the sides of the animal's cheek, crossed connections making an effective leverage uniting the cheek rings with the reins, while bit rings forming levers are held at the ends of the mouth bar, the bit rings forming a loose support for the crossed connections. The pressure on the side of the mouth and lower jaw prevents the animal from holding the bit, thus facilitating the holding of vicious animals and strong pullers.

BOOT FOR ANIMALS.—Lindsley H. Smalley, Coon Rapids, Iowa. This boot fits the animal's leg below the fetlock, extending from the fetlock to the hoof, and below the fetlock on the outside of the boot is held a horizontal ring composed of a series of rollers. An animal provided with this boot, on passing the foot over a barb wire or other obstruction, can conveniently withdraw the foot, the wire not coming directly in contact with the foot, and the rollers readily rolling it off as the foot is withdrawn.

STOVE.—Peter Frank, Portland, Mo. In this stove a heating drum is arranged below the fire box and a flue above the fire box, there being a flue or connection leading from the fire box to the drum and upright flues leading from the drum up along the opposite sides of the fire box and opening into the top flue. The invention covers novel details of construction and combinations of parts, whereby the stove is designed to have increased heating capacity.

CHIFFONIER TURKISH BATH.—Andrew J. Cross, New York City. This bath has the appearance of a readily movable piece of furniture, its case being so constructed that when not in use it will occupy but little space, while it may be readily expanded to comfortably accommodate the bather. Dry heat is used, afforded by a gas burner or lamp, and the case has a suitable door, an opening for the neck, a second door swinging outward from one side of the case, and a folding extensible hood secured to the door and to the case to open and close with the door.

INK BOTTLE STOPPER.—Gustavus R. Weed, Orange, N. J. The ink funnel of this device is seated in an elastic diaphragm forming the top of a compressible air chamber, from which an air tube and an inner ink tube extend downward through the centrally apertured stopper of the bottle. When a slight pressure is applied by the pen a small quantity of ink is drawn up the ink funnel for use, the main body of the ink being practically sealed to prevent evaporation and keep out dust.

EUCHARISTIC WATER CRUET.—Leo C. Baudet, Mount Vernon, N. Y. Within this cruet is held a liquid cylinder at the upper end of which is a spring casing, while a pusher rod carries a tightly fitting plunger head, whereby a certain predetermined amount of water may be forced through a discharge pipe extending out beyond the lip of the cruet. The device is designed to facilitate the dispensing of an exact minimum of water for admixture with wine at the offertory of the eucharistic service.

VEIL CLASP.—Clarence M. Day, New York City. This is a clasp or brooch of oblong shape, resembling when closed a hinged sleeve or collar button. It may be made either plain or ornamental, of metal or other material, and is mainly designed to hold a veil on the back of a lady's hat without directly pinning it on, the clasp not requiring to be removed with the veil, but virtually being part of the trimming of the hat. The manufacture of this pin in large quantities has been commenced by Messrs. Stone Bros., No. 535 Broadway, New York City.

HAT.—Isabella Shepard, Niles, Mich. This hat is provided with a fabric strip having its lower edge exposed and formed with a series of loops, such as is afforded by a piece of gimp, whereby a hair pin may be passed through the strip loops at any desired point, and a pin need not be thrust through the hat to hold the latter on the head.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

HYMNS AND METRICAL PSALMS. By Thomas MacKellar, Ph.D. Philadelphia: Porter & Coates.

This book consists of selections of sacred verse evidently made on no other basis than that of satisfying the deeply devotional spirit of the author. Those in sorrow and affliction cannot fail to find here much that is comforting. The book is also an excellent specimen of severely good and refined taste typographically, its author having been for many years at the head of one of the largest type foundries in the world.

ORNAMENTAL IRON. Chicago, Ill.: The Winslow Bros. Co. 1893. Oblong 4to. 141 photogravure plates.

The Winslow Company are noted for the excellence of their ornamental iron, and buildings all over the country contain specimens of their work, which is highly artistic, as the present volume fully testifies. The plates are beautifully executed and the book is a charming art volume. Stairways, balconies, railings, and newels seem to be a specialty of the firm, and forty plates are devoted to them. Some of the designs for elevator inclosures and elevator cabs are very beautiful. We notice that a great deal of the wrought iron work is Bower-Barffed.

EXPERIMENTS ON MAGNESIA ALBA, QUICKLIME, AND OTHER ALKALINE SUBSTANCES. By Joseph Black, M.D. 1893. Alembic Club Reprints, No. 1. Edinburgh: W. F. Clay. 12mo. Pp. 47.

Black's paper on "Magnesia Alba," etc., was first published in 1755, and was afterward reprinted several times, but even the reprints have become very scarce. This paper was one of the foundations of chemistry as an exact science. This book places within the reach of every student of chemistry a model of clear reasoning and of inductive investigation, which is second in this respect to nothing in chemical literature.

PHOTOGRAPHIC MOSAICS FOR 1893. Edited by Edward L. Wilson. Profusely illustrated. 1893. New York: E. L. Wilson. 12mo. Pp. 283. Price 50 cents.

The text in the present volume of "Mosaics" is very good, a large proportion of the articles having been written by well known amateurs, while Mr. Wilson has performed his task of selection with excellent results. The illustrations are in half tone, many very good. The roll of contributors includes Dr. Janeway, W. K. Burton, Dr. Liesegang, Dr. J. J. Higgins, Dr. J. M. Eder, Leon Vidal, E. L. Wilson and others.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5214) W. C. A. says: I have in my possession some old medals which I wish to duplicate in some cheap metal. How can I make a mould, and what metals nearest resemble silver? I have tried plaster of Paris, but it always blurs, and is not clear in the center. The figures on the medals are very clear, although they are very old. A. There should be no difficulty in making good plaster casts and running type metal or fusible alloy into the casts. Casts may also be taken in a mixture of beeswax and plumbago and an electro deposit of copper made to represent the medal. Casts of medals are also made in fusible alloy and the medal reproduced by electrical deposit of copper. The various processes of duplicating medals by plaster casts are described, with the method of electro deposit, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 310.

(5215) A. B. C. asks how to obtain the smoothest finish with Portland cement. How will I proceed to put half-round grooves, three-sixteenths inch wide and one-sixteenth inch deep, on this surface. Shall I let the cement harden, or proceed while still soft? This is to be used for a revolving liming table in a concentrator. A. Use a hard polished steel trowel on the surface just before it sets, and for polished grooves a polished steel plate with ribs at one edge, also of polished steel, of the form of the grooves.

(5216) L. L. C. writes: The water in which we wet sole leather for cutting becomes offensive in two or three days' use. Is there any cheap disinfectant we could introduce to correct this without injury to the leather? A. We suggest the addition to the water of a little salicylic acid. Renewal of the water would seem more practical.

(5217) W. D. L. asks: When steam in any proportion mixed with air is used for the combustion of petroleum vapor, is there gain or loss in heating power of flame produced? If a gain, what is right proportion, and what formula would express reaction between steam and vapor? What should be the temperature of flame from petroleum vapor and air regenerated to 600° Fah.? A. The only apparent value of the steam in an aero-steam-petroleum blast is for the power it gives in injecting the blast into the furnace. In experiments made with a steam-petroleum vapor blast, a temperature of a cherry red heat, about 1,400° Fah., only could be obtained, while a compressed air and petroleum vapor blast produced a welding heat, about 2,000° Fah. We infer that although a small portion of the steam may be decomposed into its elements, and thereby contribute to intensity of combustion, the larger portion necessary for the blast power contributes nothing toward combustion, and by its displacement and absorption of heat from the other elements of combustion, retards the intensity of the heat. A compressed air jet superheated to 600° feeding a furnace with petroleum vapor, properly proportioned for the most perfect combustion, should give a furnace temperature sufficient to melt iron. We have no exact data of proportions, which are usually regulated by valves to give the best effect.

(5218) H. H. Q. says: Having had some trouble in my occupation, in the way of my boiler warping over the fire and leaking, would like to know if there is any other cause for this besides banking fires too near it or oil in the exhaust water going into it. A. The caking in your boiler is the cause of the warping or bulging of the fire sheets. If the exhaust is condensed or dripped into the water used for feeding the boiler, there will be a gradual accumulation of the cylinder oil in the boiler. This gathers the scum, dirt, and scale into cakes, which finally lodge on the bottom of the boiler, and when the lodgment takes place over a fire sheet, there is great danger of destruction to life as well as the boiler. The bulging cannot take place unless the spot is red hot, which shows that the cake is thick enough to prevent the water reaching the plate. Under the boiler pressure the hot iron sags, and if not immediately arrested by cleaning out, will soon make a rupture that will pass for a boiler explosion. The only remedy for this evil is to use clean water only, heated in a heater that keeps the exhaust separate, or use one of the separators and filtering heaters that are on the market.

(5219) C. H. A. asks: How much more power does it take to run an engine and train of six cars 120 miles an hour than same train 30 miles per hour? A. The increase of speed at the wide margin of 30 to 120 miles is as yet a very uncertain power problem, as a speed of 112 miles per hour has been at short spurts only, and the conditions involved in wind resistance and friction of rolling parts are only known at the ordinary car speeds in use. The air resistance increases nearly as the square of the speed. The resistance of oscillation and concussion also increases in a like ratio, with a small decrease with loaded cars, owing to increased weight for equal resistances, as the measure usually used is expressed in pounds of resistance per gross ton of weight. The experiments on resistance at ordinary speeds indicate that the square of the relative increase in velocity in miles per hour is equal to the relative total resistance at the two speeds. This may also be subject to modification for unknown factors. Approximately the increase of power would be sevenfold from a 30 mile speed to a 120 mile speed.

(5220) G. F. asks: Which is the stronger of two locomotive engines alike in every respect except one has 24 inches and the other 12 inches stroke, the steam pressure being the same? If a difference, what causes it? A. For its ability to pull a train, the locomotive with the long cylinder is the stronger by the difference in the lengths of their cylinders, for although the total pressure on the pistons is the same in both engines, and in this sense the strength may be said to be equal, the greater length of crank of the longer cylinder gives a greater or twice the wheel pull that is obtained from the short crank and cylinder. Again, the long cylinder requires twice as much steam to do twice the work of the short cylinder with equal pressures, and again with equal weights of steam the long cylinder locomotive will not be stronger than the short cylinder one.

(5221) K. asks: 1. What is the best battery for decomposing water and the voltage of same? A. To decompose water on the large scale a low potential heavy current dynamo is the best. Two volts is ample potential difference. 2. With such a battery, how long would it take to collect 50 cubic feet of hydrogen? A. One coulomb of electricity corresponds to 0·00016 grain of hydrogen gas, 50 cubic feet of hydrogen weigh 1·848 grains, corresponding to 11,500,000 coulombs. A 100 ampere current would give this quantity of hydrogen in about 32 hours. 3. Could copper electrodes be used? If not, what would be the best substitute for platinum electrodes? A. Copper or iron electrodes can be used in caustic soda solution. We have described with full illustrations the construction of electroplating dynamos in our SUPPLEMENT, Nos. 720 and 798.

(5222) M. P. asks: Please let me know if I can burn bricks thoroughly in six days. Also let me know if I can burn bricks thoroughly by the sides of the walls, and is there a book referring to the subject? Also do I need a solid wall or only serving to burn the brick hard, and do you cover the top of your kiln with clay? A. Bricks can be burned in six days in small kilns and strong firing. The chances of making good brick are not insured by quick firing and short time, as the moisture should be discharged slowly in order to keep the brick in good shape. The brick next the outer wall are the last to heat, and make soft brick, so that a good outside wall and serving pays in making good brick at the outside. The top is gradually covered as the burning is finished. See an excellent work on "Brick Making and Burning" by Creary, $2.50 mailed.

(5223) J. A. W. says: Given the length of keel, length over all, beam and depth of hold, what is the rule for determining the weight of ballast a boat will sustain if she is capsized or filled with water? I am in doubt as to whether there is such a rule or not. A. There is no rule applicable to the amount of metallic ballast a yacht or sailing boat will carry and float in case of filling with water. It depends upon the actual quantity of wood and the specific gravity of the various kinds used in construction, offset by the relative quantity and specific gravity of the metals used, to determine the flotation of the boat when waterlogged. Many yachts with loaded keels will go the bottom if waterlogged. Some have watertight compartments or air vessels on board to counteract the weight of the ballast in case of accident. As a rule the best practice is to put in watertight compartments to just compensate for the weight of the ballast in the weight of water that the compartments will hold.

(5224) I. B. asks: A ditch is cut in a tunnel with sides and bottom rough, three feet wide at the top, one foot wide at the bottom and one foot deep, and has a pitch of four inches in one hundred feet. How many gallons of water will it discharge per minute and at what velocity will it flow? Please give rule. A. The ditch will discharge 40·658 gallons per minute and will have a velocity of $2\frac{1}{10}$ + feet per minute. The formula is cubic feet per second = $C a \sqrt{rs}$, in which C is the coefficient of flow, which for rough rock ditch is 40. A = area of section = 2 sq. ft., r = hydraulic radius, which = $\frac{\text{area}}{\text{wet perimeter}}$ = $\frac{2}{3·82}$ = 0·5235. S = slope $\frac{4}{12} \times 100 = \frac{1}{300}$ or 0·00333. Then $40 \times 2 \times \sqrt{0·5235 \times 0·00333} \times 60$ seconds = $200\frac{1}{10}$ cubic feet per minute and $\frac{2}{2}$ = 100 feet per minute velocity. Discharging 1,501 gallons per minute.

(5225) H. B. C., Ceylon, writes: I want to polish two brick pillars (in a church) that have been plastered 1 inch thick with lime mortar. I did succeed in getting a polish on them with the use of white of eggs and a rubbing with soapstone, but the polish went off in a month. Can you give me a recipe for a permanent polish, so that the pillars may look like a marble polish? A. It will be necessary in your climate to use paint and finish with a thin varnish. The white of egg and soapstone already on the columns will make a good foundation for a coat of paint of any desired color.

(5226) P. W. C. says: In your SUPPLEMENT, vol. 35, No. 909, you describe an engine governor called the "kratostate," designed to regulate both speed and power. Will you kindly tell me wherein the old form of centrifugal pendula are insufficient for the purpose, and what particular value an appliance for regulating the power more faithfully would have? A. The centrifugal governors for marine purposes do not act uniformly in a rolling ship. The most successful governors for vessels in a rough sea have for a long time been constructed on the principle of air resistance, as is also the "kratostate." The same principle is also applicable to land engines and is largely used for small governors on a large class of machinery where light-running governors are needed.

(5227) G. H. asks: Can a petroleum and gasoline engine be made smaller than one horse power? If not, why? What is the tensile strength of good cast iron? A. Gasoline engines have been made as small as half horse power. There is no reason why smaller powers may not be made for both petroleum and gasoline engines if there was a market for them. Good cast iron should have a tensile strength of not less than 17,000 pounds per square inch. The best, used in guns, has a tensile strength of about 20,000 pounds.

(5228) C. H. B. asks: Will you kindly inform me of one of the best, cheapest, and most effective disinfectants? Please give me a prescription giving the different ingredients and quantity to use to make one gallon liquid. A. Probably the most effective disinfectant is chloride of lime mixed with water, about half a pound to a gallon of water. The dry chloride is also a most efficacious disinfectant when placed in shallow basins and exposed to infection air in confined places, as under sinks and water closets. It is exceedingly penetrating and will destroy or drive out vermin.

(5229) W. C. F. writes: I am experimenting on storage batteries and am in a difficulty, and would deem it a favor if you will give me some assistance. I want to find out the way to make the composition or filling that is used in filling the perforated lead plates in making storage batteries (4 volt). A. For a paste for the filling of your battery plates use red lead mixed into a thick putty or paste with a 10 per cent solution of sulphuric acid (acid 1 part, water 9 parts). 2. The solution I am using is 5 parts water to 1 part common sulphuric acid. A. We think your solution is too strong.

(5230) J. S. says: A rope one inch thick is wound around a pole 50 feet high, 6 feet in circumference at the bottom, and 3 feet in circumference at top. Rope is wound around pole from bottom to top so as to cover the entire surface. How far must an eagle tied to the top end of the rope fly in order to unravel the entire rope? The problem is to ascertain the distance of a spiral. Is there any rule or method by which this can be obtained accurately or even approximately? A. The problems may be worked out by adding the half diameter of the rope multiplied by 3·1416 to the circumference of each end and laying out a right-angled triangle for each inch in length of the pole, in which the short leg is 1 inch. The long leg equals the circumference, and the hypotenuse by computation will equal the diagonal lay of the rope. The unwinding of the rope will make a progressive spiral whose length by computation is worthy of the time of anybody who has nothing else to do.

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